PELAGIC FISHERIES OF THE WESTERN PACIFIC REGION

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Honolulu, Hawaii

Cover Photo: Hawaii Longline Vessels in Honolulu Harbor
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1995 Annual Report

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National Marine Fisheries Service
2570 Dole Street
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August 1996

Prepared by the Pelagics Plan Team and Council Staff

for the

Western Pacific Regional Fishery Management Council
1164 Bishop Street, Suite 1405, Honolulu, Hawaii 96813

A report of the Western Pacific Regional Fishery Management Council pursuant to
National Oceanic and Atmospheric Administration Award No. NA47FC0026

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Pelagic Fisheries of the Western Pacific Region -- 1995 Annual Report

Introduction

Background

The Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) on 23 March 1987. The Western Pacific Regional Fishery Management Council (WPRFMC or Council) developed the FMP to manage the pelagic resources covered by the Magnuson Fishery Conservation and Management Act of 1976 and occurring in the US Exclusive Economic Zone (EEZ) around American Samoa, Guam, Hawaii, the Northern Mariana Islands, and other US possessions in the Western Pacific Region (Johnston Atoll, Kingman Reef & Palmyra Island, Jarvis Island, Howland and Baker Islands, and Wake Island).

The objectives of the Pelagics FMP were revised in 1991. The abridged objectives are to:

- Manage fisheries for management unit species to achieve optimum yield.
- Promote domestic harvest of, and domestic fishery values associated with, Pacific pelagic management unit species, or PPMUS[1] (e.g., by enhancing the opportunities for satisfying recreational fishing experience, continuation of traditional fishing practices, and domestic commercial fishermen to engage in profitable operations).
- Diminish gear conflicts in the EEZ, particularly in areas of concentrated domestic fishing.
- Improve the statistical base for conducting better stock assessments and fishery evaluations.
- Promote formation of regional/international arrangements for assessing and conserving PPMUS throughout their range.
- Preclude waste of PPMUS associated with longline, purse seine, pole-and-line or other fishing operations.

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[1] The Magnuson Act was amended to allow the inclusion of tunas in US fishery management authority as of January 1992. In the Pacific, tuna management is the responsibility of the regional fishery management councils. Pacific pelagic management unit species (PPMUS) includes former pelagic management unit species (PMUS) and tunas.

- To promote domestic marketing of PPMUS in American Samoa, Guam and Hawaii.

The Pacific pelagic management unit species (PPMUS) are[2]:

English Common Name	Scientific Name
Mahimahi (dolphinfishes)	*Coryphaena* spp.
Wahoo	*Acanthocybium solandri*
Blue and black marlins	*Makaira* spp.
Striped marlin and shortbill spearfish	*Tetrapturus* spp.
Swordfish	*Xiphias gladius*
Sailfish	*Istiophorus platypterus*
Requiem sharks (oceanic species)	family Carcharhinidae
Thresher sharks (oceanic species)	family Alopiidae
Mackerel sharks (oceanic species)	family Lamnidae
Hammerhead sharks (oceanic species)	family Sphyrnidae
Yellowfin, bigeye, albacore, and bluefin tunas	*Thunnus* spp.
Skipjack tuna	*Katsuwonus pelamis*
Kawakawa	*Euthynnus affinis*
Frigate and bullet tunas	*Auxis* spp.
Slender tuna	*Allothunnus fallai*
Dogtooth tuna	*Gymnosarda unicolor*
Mackerel	*Scomber* spp.
Moonfish[3]	*Lampris* spp.
Oilfish	family Gempylidae
Pomfret (oceanic species)	family Bramidae

Non-tuna PPMUS are sometimes referred to as "other PPMUS" in this report. This term is equivalent to the PMUS (Pelagic Management Unit Species) used in annual reports previous to 1992, before tunas were included in the management unit.

The PPMUS are caught in the troll, longline, handline, and pole-and-line (baitboat) fisheries. They are caught in oceanic as well as insular pelagic waters. Most of these species are considered to be epipelagic because they occupy the upper most layers of the pelagic zone. All are high-level predators in the trophic sense. Pelagic fisheries for PPMUS are among the most important, if not the dominant, Pacific island fisheries.

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[2] Classifications in this table follow Amendment 6 to the FMP, effective 27 November 1992.

[3] Moonfish, oilfish, and pomfret were added to the FMP by Amendment 7, effective 24 June 1994.

The FMP requires the Council's Pelagic Plan Team (Team) to prepare an annual report on the status of the pelagic fisheries taking place in each of the island areas served by the Council (American Samoa, Guam, Hawaii, and Northern Mariana Islands), evaluate the effectiveness of the FMP in meeting its goals and objectives, and make recommendations for future management and administrative action.

Report Content

This report contains fishery performance data from each of the four island groups through 1995, interpretations of trends or important events occurring in the fisheries, and recommendations. This report was prepared using reports submitted by the following agencies. The Hawaii report is an integration of State of Hawaii and NMFS summaries.

- Territory of American Samoa, Department of Marine and Wildlife Resources
- Territory of Guam, Division of Aquatic and Wildlife Resources
- Territory of Guam, Department of Commerce
- State of Hawaii, Division of Aquatic Resources
- Commonwealth of the Northern Mariana Islands, Division of Fish and Wildlife
- National Marine Fisheries Service, Southwest Region (including Southwest Fisheries Science Center Honolulu Laboratory, Pacific Area Office, and Office of Enforcement)
- US Coast Guard, District 14
- Pacific Fisheries Research Program, University of Hawaii

Report Appraisal

Report content has not changed significantly from previous years.

1995 Plan Team Members

American Samoa:
Mr. Alan Kingsolving
Mr. Fini Aitaoto
Dept. of Marine & Wildlife Resources
P.O. Box 3730
Pago Pago, AS 96799
Tel: (684) 633-4456
Fax: (684) 633-5944

Guam:
Mr. Thomas Flores, Jr.
Div. of Aquatic & Wildlife Resources
Department of Agriculture
192 Dairy Road
Mangilao, GU 96923
Tel: (671) 735-3955/56
Fax: (671) 734-6570

Hawaii:
Dr. Robert Skillman
Dr. Christofer Boggs
Mr. David Hamm
Dr. Samuel Pooley
Dr. Jerry Wetherall
Mr. Russell Ito (1996)
Honolulu Laboratory
National Marine Fisheries Service
2570 Dole St.
Honolulu, HI 96822
Tel: (808) 943-1221
Fax: (808) 943-1290

Dr. Richard Brock
University of Hawaii Sea Grant
1000 Pope Rd.
Honolulu, HI 96822
Tel: (808) 956-8191
Fax: (808) 956-2858

Mr. Walter Ikehara, Chair
Division of Aquatic Resources
Dept. of Land & Natural Resources
1151 Punchbowl Street #330
Honolulu, HI 96813
Tel: (808) 587-0096
Fax: (808) 587-0115

Dr. John Sibert
SOEST/JIMAR
University of Hawaii
1000 Pope Rd.., MSB 312
Honolulu, HI 96822
Tel: (808) 956-4109
Fax: (808) 956-4104

Mr. Gordon Leslie
RR 1, Box 179
Captain Cook, HI 96704
Tel: (808) 328-9060

Dr. John Kaneko
Pacific Management Resources, Inc.
3615 Harding Ave.
Honolulu, HI 96816
Tel: (808) 735-2602

Mr. Robert Endreson
Hawaii Fishermen's Foundation
305 Hahani St. #181
Kailua, HI 96734
Tel: (808) 262-2476

Mr. James Witten
1639 Kamole St.
Honolulu, HI 96821
Tel: (808) 373-4229

Northern Mariana Islands:
Mr. Michael Trianni
Division of Fish & Wildlife
Department of Natural Resources
Saipan, MP 96950
Tel: (670) 322-9729
Fax: (670) 322-3386

Council Staff:
Dr. Robert Schroeder
Western Pacific Regional Fishery
Management Council
1164 Bishop St. #1405
Honolulu, HI 96813
Tel: (808) 522-8220
Fax: (808) 522-8226

Table 1. Names of Pacific pelagic management unit species.

English Common	Scientific	Samoan or AS local	Hawaiian or HI local	Chamoru or Guam local	S. Carolinian or NMI local	N. Carolinian or NMI local
Mahimahi (dolphinfish)	*Coryphaena* spp.	Masimasi	Mahimahi	Botague	Sopor	Habwur
Wahoo	*Acanthocybium solandri*	Paala	Ono	Toson	Ngaal	Ngaal
Indo-Pacific blue marlin; Black marlin	*Makaira mazara; M. indica*	Sa'ula	A'u, Kajiki	Batto'	Taghalaar	Taghalaar
Striped marlin	*Tetrapterus audax*		Nairagi			
Shortbill spearfish	*T. angustirostris*	Sa'ula	Hebi	Spearfish		
Sailfish	*Istiophorus platypterus*	Sa'ula	A'u lepe	Guihan layak	Taghalaar	Taghalaar
Swordfish	*Xiphias gladius*	Sa'ula malie	A'u kū, Broadbill, Shutome	Swordfish	Taghalaar	Taghalaar
Moonfish	*Lampris* spp.	Koko	Opah		Ligherigher	Ligherigher
Oilfishes	*Ruvettus pretiosus; Lepidocybium flavobrunneum*	Palu-talatala	Walu, Escolar		Tekineepek	Tekineepek
Pomfret	Bramidae	Manifi moana	Monchong			
Oceanic sharks	Alopiidae; Carcharinidae; Lamnidae; Sphyrnidae	Malie	Mano	Halu'u	Paaw	Paaw
Albacore	*Thunnus alalunga*	Apakoa	ʻAhi palaha, Tombo	Albacore	Angaraap	Hangaraap
Bigeye tuna	*T. obesus*	Asiasi, To'uo	ʻAhi po'onui, Mebachi	Bigeye tuna	Toghu, Sangir	Toghu, Sangir
Yellowfin tuna	*T. albacares*	Asiasi, To'uo	ʻAhi, Shibi	Yellowfin tuna	Toghu	Toghu hangar
Northern bluefin tuna	*T. thynnus*		Maguro			
Skipjack tuna	*Katsuwonus pelamis*	Atu, Faolua, Ga'oga	Aku	Bunita	Arangaap	Hangaraap
Kawakawa	*Euthynnus affinis*	Atualo, Kavalau	Kawakawa	Kawakawa	Asillay	Hailuway
Dogtooth tuna	*Gymnosarda unicolor*	Tagi	Hagatsuo	Dogtooth or White tuna	Ayul	Owel
Other tuna relatives	*Auxis* spp.; *Scomber* spp.; *Allothunnus* spp.	(various)	Ke'o ke'o, Saba (various)	(various)	(various)	(various)

Table 2. Total 1995 pelagic landings[1] in western Pacific region.

Species	American Samoa	Guam	Hawaii	Northern Marianas	TOTAL
Mahimahi	12,122	321,014	1,000,000	18,576	**1,351,712**
Wahoo	12,796	78,530	600,000	4,555	**695,881**
Blue marlin	25,120	101,359	1,900,000	5,295	**2,031,774**
Black marlin*					**0**
Striped marlin			1,300,000		**1,300,000**
Spearfish*		738			**738**
Sailfish*	6,184	1,242		78	**7,504**
Swordfish			5,900,000		**5,900,000**
Misc. billfish			500,000		**500,000**
Yellowfin tuna	60,920	78,021	4,600,000	16,128	**4,755,069**
Bigeye	5,171		4,600,000		**4,605,171**
Albacore	54,902		3,100,000		**3,154,902**
Bluefin			100,000		**100,000**
Skipjack	179,691	192,218	1,900,000	105,389	**2,377,298**
Kawakawa*	379	1,266			**1,645**
Dogtooth	1,289	316			**1,605**
Misc. tunas	336		10,000	369	**10,705**
Sharks	6,474	11,191	3,500,000		**3,517,665**
Barracuda	3,515	1,981		153	**5,649**
Rainbow runner*	2,763	2,747		544	**6,054**
Moonfish			600,000		**600,000**
Pomfret*					**0**
Troll fish				2,365	**2,365**
Misc. pelagics	21	552	100,000		**100,573**
TOTAL	**371,683**	**791,175**	**29,710,000**	**153,452**	**31,026,310**

* NMFS Hawaii longline logbook summaries aggregate several billfish and tuna species (noted with *) into miscellaneous billfish, tuna, and pelagics categories. All Hawaii totals shown here are NMFS estimates and rounded to the nearest 100,000 lb, except for bluefin tuna and misc. tunas.

[1] Landings are reported in island reports (Appendices 1-4), which include recreational and commercial domestic landings data, where available (e.g., for Hawaii, only commercial landings). In some cases, totals may not add precisely due to rounding. These do not include foreign transshipment or domestic cannery landings, which may be reported separately in island modules.

Summary

1) No FMP or regulatory amendments governing Western Pacific pelagic fisheries were proposed by the Council in 1995. See Administrative Activities for details. No permits were requested by any foreign nation to fish in the US EEZ of the Western Pacific region in 1995.

2) In **American Samoa**, landings and effort were apparently much higher in 1994 and 1995 than in previous years. However, this was primarily due to improved supervision of data collectors which resulted in substantially larger estimates of daily participation on creel survey days, causing a corresponding increase in estimated landings. An estimated 372,832 lb (+45%)[1] were landed by pelagic fishermen in 1995. Commercial landings were an estimated 355,722 lb (+44%), with a value of $401,239 (+15%). The average price for all pelagics was $1.13/lb (-28%), continuing a decline since 1993.

The number of boats in the pelagic fishery increased 10% from 1994. Forty-four vessels made an estimated 2,496 trips (+44%), and the average trip duration was 6.4 hr/trip (-3%). Trolling was the primary method used. Catch rates for all pelagics was slightly higher than 1994. Catch rates for non-tuna PPMUS changed little except for an increase in wahoo catch rates and was generally the same as 1994 for tunas.

A new figure 14 in Appendix 1 shows total cannery landings in American Samoa from 1988-1995. Landings composed of 125,300 t of skipjack, 27,300 t of yellowfin, and 40,000 t of albacore were received at the cannery in 1995, the total exceeding local landings by a factor of a thousand. Most of the fish were taken in distant water fisheries.

Frozen fish purchased or bartered from foreign longline vessels moored in Pago Pago Harbor competed with pelagic fish landed by domestic fishermen. The first documentation of the leakage fish market is attached as Appendix 1A.

3) **Guam** landings of all pelagics increased to 791,176 lb (+19%), but total revenues decreased to $537,889 (-9%), and adjusted revenue decreased 14%. Other PPMUS landings rose to 514,391 lb (+38%), but adjusted revenue fell to $361,363 (-18%). Tuna landings declined slightly to 271,505 lb (-3%) but adjusted revenues of $173,629 remained about the same. The big increase was due almost entirely to another big rise in mahimahi landings, though not reaching the peak set in 1993. Mahimahi made up 41% of the total pelagic landings, followed far behind by skipjack (24%), blue marlin (13%), wahoo (10%), and yellowfin tuna (10%).

Guam's adjusted prices have continued to decline since 1980, although the trend is not apparent in 1995. The apparent decline may be due to the use of a Consumer Price Index that may need expansion of coverage and updating.

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[1]Percentages in parentheses indicate percent change from previous year.

The estimated number of trolling vessels reached a new record high of 436 (+33%), continuing a generally rising trend. The big increase in 1995 is due to the addition of two other marinas to the expansion, but there is a general increase in the number of small boats participating in Guam's fisheries during the past 15 years. The number of trips (18,214, +21%) and hours fished (68,285, +9%) increased from 1994, but hours per trip (3.8, -10%) declined slightly.

Guam Department of Comnmerce reported that 448 foreign longliners made 1,948 port calls and transshipped 12,733 t of fish through Guam. This included 7,872 t of yellowfin tuna (62%), 3,658 t of bigeye (29%), 568 t of blue marlin (4%), and 635 t of albacore, black marlin, striped marlin, swordfish, and other species (5%). All of these fish were allegedly caught outside Guam's EEZ.

4) The **Hawaii** fisheries for PPMUS produced total pelagic landings of 29.7 million lb in 1995, a 21% increase from 1994. Swordfish landings (5.9 million lb) declined 16%, continuing the decline seen in 1994. Swordfish continued to be the dominant species (20%) in the pelagic fishery, but only just ahead of bigeye or yellowfin tunas (15%). Striped marlin landings increased by 62%. Mahimahi landings were about the same as 1994 and near the 1987-1994 average. Combined tuna landings (14.3 million lb) were up 26%, and landings of almost all tuna species were higher than in 1994. Estimated whole weight shark landings doubled to 3.5 million pounds.

Total pelagics revenue decreased 1.5% to $52 million and total adjusted revenue declined 3%, due to lower prices for all pelagic species. The inflation-adjusted ex-vessel revenue for the longline fishery showed little change (+1.5%). Adjusted revenue of the troll and handline fisheries decreased 19% and baitboat dropped 14%.

Changes in catch rates for trollers varied by species in 1995. Mahimahi (-28%), blue marlin (-7%), and yellowfin (-4%) catch rates dropped, while wahoo (+38%) and skipjack (+5%) rose. Catch rates for handline changed relatively little from 1994, except for swordfish, which rose 25%. Baitboat catch rates of skipjack rose slightly (+4%).

The Hawaii longline fleet landed 22.6 million pounds of pelagic fish, a 25% increase from 1994, due mainly to increased tuna landings. Of the billfish landed in Hawaii, longlining accounted for almost all of the swordfish and striped marlin, and 66% of the blue marlin. About 40% of the longline landings (approx. 8.7 million lb) were billfish (67% of billfish landings were swordfish). The longline fleet also accounted for most of the bluefin tuna (100%), bigeye tuna (98%), albacore (63%), mahimahi (55%), moonfish (100%), and sharks (99%) landed in Hawaii. Estimated shark catches continued the steep rise from 1993 due to substantial landings of shark fins by longline vessels. The bluefin tuna landings tripled from 1994.

Hawaii's troll and handline landings of pelagics decreased to 4.9 million lb (-9%), near the long-term average. Yellowfin tuna and wahoo were the only major species caught predominantly by troll and handline fishermen. Baitboat and troll fishermen caught almost all of the skipjack tuna.

Fishing effort for the combined pelagic fisheries in Hawaii remained at a high level in 1995. The number of longline vessels increased from around 40 in 1983-87 to 141 in 1991. In 1995, 110 vessels were active in the fishery, the lowest since 1988, although the number of trips (1,125) increased 2% and the number of hooks set (13.3 million) increased 11%. The number of trips by the troll fishery increased 9% to 22,792, slightly higher than the 1979-95 average of 17,549, but has remained almost constant since 1986. The number of trips taken by skipjack tuna baitboats (373) rose 33% but was still below average. The number of handline trips (5,165) reversed the recent decreasing trend, with a rise of 25% from 1994.

5) Landings of all pelagics in the **Northern Mariana Islands** (NMI) increased 36% to 159,487 lb, due mainly to an increase in skipjack tuna catch of over 30,000 lb. The increase may be due also to better sampling. The wide variation in CNMI commercial landings for the last several years were mainly due to variations in skipjack tuna landings, despite record landings of some other species. Skipjack landings were 43% higher (105,389 lb) than 1994, although still below the long-term average. Yellowfin tuna landings were also high (+52%) and somewhat higher than average. Landings of mahimahi were up 55% from 1994 and were above the long-term average. Wahoo landings rose 47%, but were still below the long-term average, though not significantly. Blue marlin landings more than doubled (+151%) and well above the long-term average.

With the big increases in landings, total revenue rose 39% ($287,547) and adjusted total revenue rose 37%. Tuna adjusted revenues rose 46% and other PPMUS adjusted revenues were up 48%.

The number of fishermen making commercial pelagic landings rose to 89 (+35%) from 1994, continuing a recovery from the low of 54 in 1993. The number of trips landing PPMUS reached a new high of 1,713, well above the long-term average.

The inflation-adjusted prices of other PPMUS and tunas have remained fairly stable since 1983, with the exception of a peak in other PPMUS prices in 1990 and a broad rise in tuna prices from 1990-1992. Prices have returned to long-term averages in 1995.

6) The **swordfish** longline fishery in Hawaii began in 1989 with landings estimated at 0.6 million lb, increasing to 3.4 million lb in 1990, and peaking at 13.1 million lb in 1993. Swordfish landings continued the decline from 1994, to 5.9 million lb in 1995. The estimated average size of longline-caught swordfish actually rose to 167.0 lb in 1995, slightly above the 1987-1995 average. Swordfish comprised the largest proportion of the total non-tuna landings by all fisheries in Hawaii for the sixth consecutive year (38% in 1995, 60% in 1994, 72% in 1993, 73% in 1992, 62% in 1991, and 38% in 1990). The longline catch rate of swordfish was lower than 1994, but this is due partly to the longline fleet expending relatively more effort pursuing tuna. (See detailed report by Christofer Boggs in Appendix 3A.) Swordfish landings from non-longline gear were negligible in comparison. Other areas did not report landings of swordfish.

7) In American Samoa, **blue marlin** landings reached a new peak of 25,120 lb, double the previous record. Guam landings of blue marlin (101,359 lb) were 17% lower than 1994, ranking third behind mahimahi and skipjack tuna. Blue marlin landings (1.9 million lb) in Hawaii were

27% higher than 1994 and a record high. Longliners accounted for 66% of the total Hawaii blue marlin landings. Blue marlin landings in the Northern Marianas (5,295 lb) were second only to the record high of 1992.

The catch rate of blue marlin in the American Samoa troll fishery was about the same as 1994, still relatively high and above average. In Guam, blue marlin troll catch rates decreased slightly. The catch rate of blue marlin in the Hawaii longline fishery increased because of an increase in tuna targetted trips. Blue marlin tends to be caught incidentally at a higher rate on tuna trips than swordfish trips. The catch rate of blue marlin in the Hawaii troll fishery dropped slightly (-7%), but was within the long-term average. In the Northern Marianas, the 1995 marlin catch rate was almost double 1994's catch rate and above the long-term average.

The average size of blue marlin in the Guam International Fishing Derby dropped to 132.9 lb from 1994's 148.6 lb, but more were caught.

8) **Striped marlin** landings ranked third among the billfish in Hawaii (after swordfish and blue marlin), where it accounted for 8% of the commercial landings of non-tuna PPMUS. The 1995 landings of 1.3 million lb were 63% higher than 1994 landings and on the long-term average. Striped marlin is regarded as a secondary target species (after bigeye tuna) in the winter longline fishery, and it tied for second with blue marlin after swordfish in total longline landings of billfish. Landings in the Hawaii troll and handline fisheries (91,000 lb, +17%) were close to the long-term average. The species rarely appears in the domestic landings from other areas.

9) **Shortbill spearfish** made up less than 1% of the PPMUS landings in Hawaii, and rarely appeared in the landings reported for other areas.

10) **Sailfish** landings were insignificant in most areas. American Samoa reported relatively substantial landings of 6,184 lb of sailfish in 1995.

11) **Mahimahi** landings (12,122 lb) in American Samoa rose slightly from 1994. Guam's 1995 mahimahi landings (321,014 lb) were almost double 1994 but did not reach the record high of 1993. The Guam landings continue to display the wide, unexplained annual fluctuations seen since 1987. The trolling catch rate rose accordingly. Mahimahi landings (1.0 million lb) made up 6% of the 1995 non-tuna PPMUS landings in Hawaii, little changed from 1994. The longline fishery accounted for 55% of the 1995 landings, topping combined troll and handline landings. The troll catch rate in Hawaii was 28% lower than 1994, but within the long-term average. Northern Marianas mahimahi landings went up to 18,576 lb (+55%) and accounted for 54% of the total non-tuna PPMUS landings. The trolling catch rate rose 10% and was within the long-term average.

12) **Wahoo** landings in American Samoa (12,796 lb) were at another new high, and the catch rate hit a new peak, higher than average. Guam's wahoo landings (78,530 lb) rose by 22% and catch rates were about the same as 1994. Wahoo landings in Hawaii for 1993 (0.6 million lb) increased 50%, but, as usual, did not deviate much from the long-term average. The trolling

catch rate for Hawaii was 38% higher than 1994, but within the long-term average. Northern Marianas wahoo landings (4,555 lb) increased 47% but was still within the long-term average.

13) Estimated Hawaii **shark** volume was double the previous year. The landings reported here are only domestic landings. The increase is due to increased landings of shark fins. Shark fin prices ranged from $15 to $20/lb ex-vessel, depending on condition and species[1]. Shark landings from other areas were relatively minor. The Bottomfish Plan Team also noted[2] that Northwestern Hawaiian Islands bottomfishermen were also landing shark fins, although the quantity was not estimated.

14) **Yellowfin tuna** landings in American Samoa (60,920 lb) increased 22%, although catch rates were about the same as 1994. Guam yellowfin landings (78,021 lb) increased 10% but the catch rate was about the same. Catch rates have stabilized since about 1986 at a new lower level than the previous period. Total Hawaii landings of yellowfin (4.6 million lb) were 12% higher than 1994 and slightly higher than the long-term average. Higher landings were made by trollers and handliners (54%) than by longliners (46%). The drop in the trolling catch rate (-4%) was less than in the handline catch rate (-13%). Northern Marianas Islands yellowfin landings of 16,128 lb were much higher (+52%) than 1994 and above the long-term mean. Catch rates were 8% higher as well and on the long-term average.

15) **Skipjack tuna** landings in American Samoa in 1995 (179,691 lb) set a new record high, although catch rates changed little (+8%). Guam skipjack landings (192,218 lb, -7%) and catch rate were slightly lower than 1994. Hawaii skipjack landings (1.9 million lb) rose 27% but were still below average. The skipjack were caught mainly by baitboats. Both troll skipjack catch rate (+5%) and baitboat catch rate (+4%) rose slightly, but stayed on the long-term average. Northern Marianas Islands 1995 skipjack landings were 43% higher (105,389 lb) than 1994, reversing the decline since 1989. Although the catch rate rose 2% from 1994, it was still far below the long-term average.

16) Hawaii landings of **bigeye tuna** (4.6 million lb) were 7% higher than 1994, almost all caught by longline. No other areas reported bigeye landings.

American Samoa reported landing 54,902 lb of **albacore**, the highest yet recorded by the American Samoa fleet. Hawaii landings of albacore more than doubled and reached a new peak (3.1 million lb), due to increased landings in both longline and troll/handline fisheries. More albacore trollers fishing the North Pacific unloaded in Hawaii, but a separate total for their landings is not yet available. About 63% of albacore were landed by longliners. Other areas did not report landings of albacore.

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[1]Pers. comm. Dr. Samuel Pooley via phone conversation, July 19, 1996.

[2]WPRFMC Bottomfish Plan Team meeting, March 27-28 , 1996, Executive Centre Hotel, Honolulu, HI.

17) **Troll fisheries** dominated the domestic fisheries in American Samoa, Guam and the Northern Marianas, in contrast to Hawaii where the longline sector caught more PPMUS than the other sectors. Growing charter fishing businesses in Guam and Northern Marianas contributed heavily to troll fishing effort.

Issues

The bycatch issue has become an important concern to the team. Bycatch, as used by team, refers to species that are not the target species of the fishery, but are caught or have interactions with the fishery, including non-targetted fish species, turtles, birds, and monk seals. In some cases, bycatch species are utilized in the fishery and have high value, such as sharks are for shark fins. Bycatch, when referring to interaction with threatened or endangered species, could have significant impacts on these species and force the fishery to make changes to reduce the level of bycatch.

Recommendations to the Council

1) The Council should request the Hawaii Division of Aquatic Resources (HDAR) to develop and implement a fish dealer permitting system, and should computerize and enforce its dealer reporting system. This will further document the total volume of fish sold in the state, and will provide a cross–reference validation capability for fishermen's reports.

   Status: The Department of Land and Natural Resources (DLNR) has tried to establish (and still is) a mandatory dealer permit via Administrative Rules. This approach has met with some legal obstacles. It may be that the Department will have to obtain specific authority in Hawaii Revised Statutes (State of Hawaii law), i.e., a bill authorizing the DLNR to establish the permit must be passed in the Legislature. It is a high priority at the DLNR.

2) The Council and/or other appropriate agency should seek funding to conduct, under the Pelagics Fisheries Research Program, a survey of Hawaii small–scale fisheries. This survey is needed to evaluate the significance of non–commercial and part–time components of these fisheries. The survey would build on a pilot small boat creel survey conducted in 1991.

   Status: This long-standing recommendation was retained at the request of the Team because data are still not being collected on the Hawaii non-commercial pelagic fisheries. The State of Hawaii does not yet have a non-commercial fishing license and does not collect data from non-commercial fisheries on a regular basis. No funding has been available to conduct these surveys. A current PFRP recreational economics project

(Pooley and McConnell) was not designed to address the specific needs of the Team for basic fisheries data for these fisheries.

3) The HDAR should continue to improve the collection of fisheries data so that the data provide useful information on fishing effort. They should enter into the database all information that is reported on forms especially header information that would identify the beginning and end of multi–day trips.

Status: A new database structure coming into use at HDAR now includes information to help identify multi-day trips. Furthermore, the HDAR intends to separate the reporting of catch and effort (from fishermen) and economics information (dealer report) in the future when dealer permits are implemented and dealer reports computerized. Until this is implemented, fishermen must continue to report catch and effort, and economic information.

4) The three fishery management councils with Pacific jurisdictions, along with member states and NMFS, should collaborate to ensure the collection of landing and logbook data from all domestic longline and driftnet vessels harvesting swordfish and other Pacific Pelagic Management Unit Species (PPMUS).

Status: The Secretary of Commerce has not yet responded to the Council's request for single Council designation on Pelagics.

5) The Council should support an analysis of trends in mahimahi and wahoo landings and catch rates throughout the region, particularly in the western Pacific, and including data from EEZ and distant–water fisheries. Mahimahi is an important resource and economic component of island fisheries.

Status: The Team retained this recommendation because nothing specific had yet been done along these lines, and it is still an identified need. A suggestion was made to include moonfish, but was not supported by other team members. This subject will be in the next PFRP solicitation (request for proposals).

6) The appropriate island agencies in American Samoa, Guam and Northern Marianas should investigate motivational factors relating to pelagic fishing effort, and incorporate this information into future annual reports. This information will expand and improve the interpretation of patterns in participation and effort.

Status: The Team retained this recommendation because nothing specific had yet been done to implement it. This recommendation was originally intended as a reminder to the island agencies that social and economic factors are important to understanding the dynamics of fishing effort and landings especially where relatively few fishermen provide the majority of the landings. However, the island agencies lack the manpower and

resources to conduct social-economic studies on their own. It would be appropriate to solicit and support these studies via PFRP, with Council support.

7) The Team should include a discussion of the impacts on the respective local markets of distant water pelagic fleets that are based in each area.

Status: It was further recommended that there be an explanation of how leakages of catch from foreign distant water fleets affect local fisheries, expanded to a regional level. Apparently, leakages from distant water fleets play a substantial role in fish supply in American Samoa (see Appendix 1A) and Guam. This may become an issue in Northern Marianas Islands as well as a few domestic longliners start exporting catch in a joint venture. This subject is in the current PFRP request for proposals.

8) The Council should attempt to obtain data on the total effort and catch by species, including discards, from U.S. and other purse seine fisheries within the U.S. EEZ and on the high seas.

Status: The Team acknowledged that there are some data now available on the U.S. purse seine fishery but someone needs to analyze it, not a trivial task. It was noted that the data includes landings for most tunas, but do not report blue marlin, mahimahi, and wahoo, among others, which are considered important species in the region. These are species that may be reported as bycatch, or not at all.

Plan Administration

Administrative Activities

During 1995, no FMP or regulatory amendments governing the western Pacific pelagic fisheries were proposed by the Western Pacific Regional Fishery Management Council; hence, no regulatory action related to the pelagics FMP was required by the NMFS Southwest Region (SWR).

Longline Permits

The SWR Pacific Area Office (PAO) issued/renewed 164 Hawaii longline permits (see attached list) and 11 western Pacific general longline permits for American Samoa, Guam, and Northern Marianas Islands. During 1995, there were 37 transactions for permit transfer (3 per month), which meant that about 23 percent of those holding Hawaii longline permits in January 1995 did not hold permits at the end of the year.

In 1995, 10 percent of the Hawaii longline permits (17 of 164 permits) were held by persons who did not own vessels as allowed under the limited entry program. These permit holders were issued "non-valid longline permits" that could be validated at a later date by presenting to NMFS

a U.S. Coast Guard certificate of documentation verifying ownership of a vessel. A list of all Hawaii longline limited-entry permit holders is on page 17-18.

PAO received a total of $6,357 in longline permit fees, which were deposited in the U.S. Treasury. The application fee in 1995 was $39.00. Beginning in 1996, the fee will be reviewed, and revised if needed, every two years rather than on an annual basis.

Foreign Fishing Permits

No administrative actions relating to foreign fishing in the western Pacific EEZ were required because no foreign fishing permits were requested for any vessels with which the USA has a Governing International Fishing Agreement.

Protected Species Conservation

In 1995, under the mandatory observer program, the SWR Observer Branch placed observers on Hawaii-based longline vessels covering 48 fishing trips.

Total observed fishing effort was 617,576 hooks, and 29 longline-turtle interactions were observed. The cumulative interaction rate was calculated to be 0.047 per 1,000 hooks set, compared to 0.067 in 1994.

Interactions mostly involved hooked turtles (26/29), of which 12 were hook ingestions. Loggerhead turtles were by far the species most often involved in observed interactions with longline gear (18 hooked, 1 entanglement). Two turtles (a leatherback and an unidentified hard shell) were lost before the type of interaction could be confirmed.

1995 Frequency and Type of Observed Longline Gear-Turtle Interactions

Turtle Species	Hooked			Entangled	Unknown
	Ingested	External	Unknown		
Loggerhead	10	8	0	1	0
Olive Ridley	2	2	0	0	0
Leatherback	0	3	0	0	1
Unidentified Hardshell	0	0	1	0	1
Green/Black	0	0	0	0	0
Hawksbill	0	0	0	0	0
TOTAL	12	13	1	1	2

Except for one Olive Ridley turtle that was retrieved dead, all turtles were retrieved alive and released alive.

SWR observers also obtained turtle tissue samples for genetic analyses, tagged and photographed turtles for future identification, and collected turtle life history data when possible.

SWR Observer Branch staff have developed a special hand-held net to retrieve hooked and entangled turtles. With this net, harm to the turtles is minimized when longline gear with a turtle is being hauled to the boat. This net is now also being used in the Atlantic and Gulf of Mexico longline fishery observer program.

NMFS Southwest Fisheries Science Center and Honolulu Laboratory scientists worked on a new method to better estimate the number of turtles taken in the Hawaii longline fishery. The new method is based on a random stratified sampling regime tied to the observer data. The previous method, a simple ratio estimator, did not take into account statistical variability associated with vessel size class or species target strata. The estimates of take are believed to be more statistically reliable. The SWR's 1995 Annual Report Concerning the Take of Sea Turtles in the Hawaii Longline Fishery will include a description of the new methodology and the results using the new statistical estimation procedure.

On December 4-7, 1995, the NMFS Honolulu Laboratory convened a meeting of twenty international turtle experts to review the population status and biology of threatened and endangered sea turtles incidentally taken in the Hawaii longline fishery and the impacts of the takes on the turtle populations. The workshop identified critical areas for improving data collection, additional analyses that need to be undertaken, and recommendations on permissible levels of incidental take in the North Pacific.

NMFS Honolulu Laboratory staff developed a computer simulation model, TURTSIM, to help assess impacts of the Hawaii longline fishery on affected turtle populations. The model incorporates turtle life history information, such as growth, maturation, remigration, reproduction, and mortality. With this model, the user is able to specify levels of uncertainty about any life history parameter, as well as levels of random variation in population process, when assessing impacts to turtle population as a result of various levels of turtle taken by longline fishery. Further work on TURTSIM will continue in 1996.

Habitat Conservation

There is no information to suggest that the habitat of pelagic management unit species was subjected to major alterations in 1995. The continuing introduction of low-level pollution from diverse sources, however, combined with occasional pulses at higher levels, is an ongoing problem. Pollution sources include runoff from high islands, sewage from island outfalls and ships, oil from ship bilges and accidental spills, hazardous waste spills, and marine debris originating from land or ships in the region, or drifting in from other areas.

Hawaii Longline Limited Entry Program
Permit Holders
December 31, 1995

VESSEL	OWNER/PERMIT HOLDER
F/V AHI	Gerald Shimabukuro
F/V ALEUTIAN SPRAY	Kristofer Knutsen/D. Gunn
F/V ALICE I	Kwang Myong Co. Inc.
F/V ALYCIA MARY	C & M Fisheries Inc.
F/V AMBER ROSE	Geoffrey Walker
F/V ANNA	MTA Corp.
F/V ARROW	David Kelly
F/V AUKAI VI	Ralph Takafuji Sr.
F/V B-52	B-52 Inc.
F/V BARBARA H	Arthur/Barbara Haworth
F/V BETTY N	Gengo Nabeshima
F/V BIG AL	Roy-Al Boat Mgmt.
F/V BIG DEAL	Roy-Al Boat Mgmt.
F/V BLUE DECEMBER	Peter I Corp.
F/V BLUE FIN	Liet An Lu/Mai Thi Do
F/V BLUE HORIZON	Pensacola Blue Horizon In
F/V BLUE SKY	Blue Sky Fishing Producer
F/V BRANDI	Success Inc.
F/V CAPT. DIAMOND	Bene Diec Dien Le
F/V CAPT. GLYNN I	Captain Glyn, Inc.
F/V CAPT. GREG	Aquanut Co. Inc.
F/V CAPT. LE	Capt. Le Inc.
F/V CAPT. MILLIONS I	Nga Van Le
F/V CAPT. MILLIONS III	Capt. Millions III, Inc.
F/V CAPT. MILLIONS IV	H and M Fishery Inc.
F/V CAPT. WASHINGTON I	Capt. Washington I Inc.
F/V CAROLINE L	Elaine Torres
F/V CHRIS	Kan-Do Pesca Inc.
F/V CRYSTAL	Crystal Inc.
F/V DAE IN HO	KYL Inc.
F/V DAEINHO III	Chunha Inc.
F/V DASHER II	DukSung Fishing Inc.
F/V DAWNING STAR	Larry B. & Dawn Powers
F/V DEBORAH ANN	Amko Fishing Co. Inc.
F/V DISCOVERY	Xanhan Le
F/V DORIS	Yong Sang Kim
F/V DOUBLE D	Joseph Dettling
F/V E.T.	Vessel Mgmt. Assoc. Inc.
F/V EAST OCEAN	Konam Fishing Co., Inc.
F/V EDWARD G	Edward G. Co. Inc.
F/V ESTHER I	Samuel Lee /Johnny Franklin
F/V FINBACK	Finback Inc.
F/V FIREBIRD	Firebird Fishing Corp.
F/V FRIENDSHIP	Alvin Tran Inc.
F/V FULL MOON	R.A.R. II Fisheries Inc.
F/V GAIL ANN	Gail Ann Co. Inc.

VESSEL	OWNER/PERMIT HOLDER
F/V GARDEN SUN	Garden Sun Boat Inc.
F/V GLORY	Roy Yi
F/V GOLDSTAR	Hyon Su Oh/Do Kyun Lee
F/V GRACE	Sang Yeol Kim
F/V HANA LIKE	Hana Like Inc.
F/V HAVANA	Thomas Webster
F/V HEOLA	H & M Marine Inc.
F/V HOLOKAI	Holokai Enterprises Inc.
F/V I'OLANI	Jeta Inc.
F/V INDEPENDENCE	Independence Inc.
F/V INTERNATIONAL	International Boat Inc.
F/V JAGUAR T-L	Jaguar T-L Corp.
F/V JANTHINA	Trans World Marine Inc.
F/V JOHN KENNEDY	Kinh Nguyen
F/V JUSTIN G	Richard/Justin Godbehere
F/V KAIMI	James Cook
F/V KASATKA	Artemon Basargin
F/V KATHERINE II	K.A. Fishing Co. Inc.
F/V KATHERINE Y	Song Fishing Corp.
F/V KATHLEEN	M&T Fishing Co. Inc.
F/V KELLY	K.Y. Fishing Inc.
F/V KELLY ANN	Kelly Ann Corp.
F/V KILAUEA	Aukai Fishing Co.Ltd.
F/V KIM THANH I	Kim Thanh I Inc.
F/V KIMMY I	Kim Tran
F/V KING DIAMOND II	Scotty Nguyen
F/V KINUE KAI	Awahnee Oceanics Inc.
F/V KOLEA	Paik Fishing Inc.
F/V LADY ALICE	Lady Alice Co. Inc.
F/V LADY CHRISTINE	Christine Tran
F/V LADY CHRISTINE II	Christine Tran Inc.
F/V LADY CHUL	Jong Ik Fishing Co. Inc.
F/V LADY LYN III	Lady Lyn Inc.
F/V LEA LEA	Jeta Inc.
F/V LIHAU	White Inc.
F/V LILA	Samuel Lee
F/V LINNEA C	Linnea C. Inc.
F/V LUSTY	Lusty Voyages Inc.
F/V MAGIC DRAGON	Dragon Fishing Co Inc.
F/V MAN SEOK	KMC & PCC Inc.
F/V MANA LOA	Hawaii Protective Assc Lt
F/V MARIE M	Viking V Inc.
F/V MARINE STAR	Viking V Inc.
F/V MIDNIGHT II	Albert K. Duarte
F/V MISS FRAN	Impetuous Inc.
F/V MISS JESSICO	Pacific Seafoods Inc.

F/V MISS JC	Quan Do
F/V MISS LISA	Miss Lisa Inc.
F/V MISS VIVIANA	Nguyen Hai Thanh/Reagan/Duoc
F/V MOKULELE	Robert Cabos
F/V MORGAN 5	Steven Ho
F/V NATALIE ROSE	Natalie Rose Gen. Partner
F/V NAVIGATOR	Warren & Vincent Ent Inc.
F/V NEW HORIZON	John D. Gibbs
F/V NO PROBLEM	K&S Fisheries Inc.
F/V NORPAC	George Rains Jr.
F/V NORTHERN VENTURE	Roy-Al Boat Mgmt.
F/V OCEAN DIAMOND	Ocean Diamond Inc.
F/V PACIFIC DREAM	Pacific Seafoods Inc.
F/V PACIFIC FIN	Fishrite Inc.
F/V PACIFIC HORIZON	John Gibbs
F/V PACIFIC PIONEER	Frank Barone
F/V PACIFIC PRIDE	Pacific Seafoods Inc.
F/V PAN AM II	Pan Am K Marine Corp.
F/V PEARL HARBOR II	Gilbert DeCosta
F/V PETITE ONE	Ka'upu Ltd.
F/V PHI NAM	Pilgrim Truong
F/V QUEEN DIAMOND	Santa Maria III Inc.
F/V RED DIAMOND	Billy Bang Truong
F/V RED OCTOBER	Pacific Fishing & Supply
F/V ROBIN	Fat City Fishing
F/V ROBIN II	Robin Fishing Inc.
F/V SANDY DORY	Highliner Inc.
F/V SEA BIRD	Ly Hoa Van
F/V SEA DIAMOND	Hung Truong
F/V SEA DIAMOND I	Sea Diamond I Inc.
F/V SEA DIAMOND II	Sea Diamond II Inc.
F/V SEA DRAGON	Long Thanh Nguyen
F/V SEA FLOWER	Sea Flower Inc.
F/V SEA HAWK	Hawaii Fishing Co. Ltd.
F/V SEA SPRAY	Parker Seafoods, Inc.
F/V SEA STAR	Vin Star Inc.
F/V SEASPRAY	Hanson/Hanson Fishing Co.
F/V SEEKER II	Seeker Fisheries Inc.
F/V SILVER SEA	Jimmy Van
F/V SONG HUONG	Phan Dinh
F/V SOUTH PACIFIC	South Pacific Fishing
F/V SPACER K	Hwa Deog Kim
F/V ST. ANTHONY	Johnny Chinh Truong
F/V SUN FLOWER #1	TX, Inc.
F/V SUN STAR	Sun Fishing Co. Inc.
F/V THREE JACKS	Kyong Suk Om
F/V TIFFANY VANCE	Tiffany Vance Inc.
F/V TOURANE	Danang Enterprise, Inc.
F/V ULHEELANI	Eugene Y Inc.
F/V ULHEELANI	Ulheelani Corp.
F/V VAN LOI	Van Loi Corp.
F/V VICTORIA	Victoria Inc.
F/V VOSTOK	Evgeny Basargin
F/V WHITE NIGHT	Zahary Basargin
F/V WONIYA	Sierra Fisheries Inc.

PERMIT HOLDER
James Welch
Ba Van
Vedoy Enterprises Inc.
Linda Huong Le
Master Vincent Inc.
John Romero
Pacific Ocean Producers
John Romero
CKM Inc.
Shaman Partnership
Paul Le
Sean Martin
Theodore Benjestorf
Pacific Ocean Producers
H&M Marine Inc.
Pacific Boat Corp. Inc.
Chun Ha Inc.

USCG and NMFS Enforcement Activities

The following report is a combined effort of the U. S. Coast Guard (USCG) 14th District and the National Marine Fisheries Service (NMFS) Southwest Region Office of Enforcement. The report covers the period 1 January 1995 through 31 December 1995.

USCG Enforcement Activities

The USCG conducted 1,229.0 hours of fisheries patrols with C-130 aircraft in the Central and Western Pacific region during 1995. The C-130 surveillance of U. S. EEZ's was broken down as follows: 208.2 hours in the Main Hawaiian Islands, 190.9 hours in the Northwestern Hawaiian Islands, including Hancock Seamount, 252.4 hours in Guam and Commonwealth of the Northern Mariana Islands (CNMI), 15.5 hours in Johnston, 186.8 hours in Palmyra/Kingman Reef, 116.3 hours in Jarvis, 76.9 hours in Howland/Baker, and 25.8 hours in Wake. There were also 156.2 hours expended on high seas driftnet enforcement. The Coast Guard flew 446.3 hours with HH-65 helicopters in support of fisheries law enforcement; this effort was concentrated in the Main Hawaiian Islands. During calendar year 1995, 240 high endurance cutter days were utilized patrolling District 14's waters.

In 1995, there were 414 total fishing vessels sighted within District 14's boundaries. Of these vessels, 108 were boarded. A breakdown of the vessels boarded is as follows: 60 were U. S., 16 were Japanese, 21 were Taiwanese, six were South Korean, two were Honduran, one was Stateless, one was Chinese, and one was from Vanuatu.

There were three significant non-VMS MFCMA law enforcement cases relating to pelagic fisheries that were prosecuted by the Coast Guard in 1995. The following information applies:

> On May 12, 1995, CGC JARVIS intercepted the Japanese F/V's MIYOU ZIN MARU NO. 131 and CHOKYU MARU NO. 15 after they had been sighted by a Coast Guard C-130 fishing inside the U. S. EEZ of CNMI. CGC JARVIS was approximately 10NM away from the vessels when they were overflown. CGC JARVIS quickly intercepted the vessels while they were still well inside the U. S. EEZ. A boarding of the vessels ensued with both masters admitting to fishing inside U. S. waters. The vessels were subsequently seized and escorted to Guam. The MIYOU ZIN MARU NO. 131 was fined $212,500; the CHOKYU MARU NO. 15 was fined $150,000. As part of the case settlement, both vessels are required to carry vessel monitoring system (VMS) transponders for worldwide tracking for a period of five years.
>
> On July 10, 1995, CGC RUSH, which was returning to Honolulu from an Alaskan Patrol, was diverted to intercept the FF/V LUYAN BU 6006. The vessel had been observed by a Coast Guard C-130 while conducting high seas driftnet fishing 600NM north of Midway Island. CGC RUSH traveled over 2,000NM and intercepted the vessel 1,200NM northwest of Midway on July 15. Although the crew of the HSDN fishing vessel had subsequently painted over the name LUYAN BU 6006, the vessel was flying a People's Republic of China (PRC) flag upon intercept. The vessel later hauled down the PRC flag. The Government of China also confirmed the HSDN vessel CGC RUSH was tracking was not of Chinese registry, and the vessel was subsequently assimilated as stateless. Upon intercept, the HSDN fishing vessel refused to all forms of communications and maintained

a consistent southwesterly course at 8-10KTS. CGC RUSH followed the vessel and conducted passive means to have the vessel stop for visit and verification. On July 19, with the vessel having refused to cooperate, CGC RUSH received permission to take more intensive measures to compel compliance. Using a mooring line, CGC RUSH successfully fouled the screws and then boarded the HSDN fishing vessel. CGC RUSH's boarding team confirmed the recent illegal fishing activity through documentation, catch on board, as well as statements by the crew. The vessel was subsequently seized under jurisdiction of U. S. law and towed into Guam. This interdiction has resulted in setting a historic precedent by being the first U. S. seizure of a HSDN fishing vessel.

On December 5-6, 1995, CGC WASHINGTON responded to a report of unattended longline gear inside the the MHI Longline Closure Area approximately 50NM northeast of Oahu. CGCWASHINGTON arrived on scene and verified the longline gear was inside the closure area; no F/V's were located in the vicinity. The longline gear was subsequently identified belonging to the F/V MANA LOA from markings on the gear. The F/V MANA LOA was located by CGC WASHINGTON in the early morning of 6 December retrieving its gear inside the closure area. A boarding of the MANA LOA revealed two previous incursions into the Longline Closure Area. The MANA LOA's voyage was terminated and the vessel was escorted back to Honolulu for further investigation by NMFS.

Vessel Monitoring System

The Vessel Monitoring System (VMS) owned and operated by the NMFS and monitored jointly by NMFS and USCG personnel has proven to be a viable enforcement tool. In 1995, there were five significant enforcement cases initiated by VMS information. Using "signature analysis," Coast Guard and NMFS personnel identified the possibility that longline fishing was conducted in restricted areas (Longline Closure Area and the Northwestern Hawaiian Protected Species Zone) around the Hawaiian Islands. The information was passed to surface units which conducted at sea boardings to investigate the information. In all five cases, the boardings revealed fishing had probably occurred during the time in question. On two of the cases, the vessel's fishing trip was terminated and the vessel returned to port. On the other three cases, the vessel's voyages were not terminated due to the completeness of the on scene investigation, the master's cooperation, and the ability to continue to track the vessel via VMS. All five cases were investigated by NMFS enforcement for prosecution.

Presently, there are 103 vessels that have installed VMS equipment on board compared to 75 vessels in 1994. More installations are planned for 1996.

The Coast Guard Marianas Section (MARSEC), located in Guam, continued its strong law enforcement program in conducting dockside boardings of foreign fishing vessels in Guam, Tinian, and Saipan. As a result of these boardings, several violations of foreign EEZ's were detected. Information from these cases resulted in the vessels being prosecuted for a Lacey Act violation and/or the information was forwarded to the FFA and respective country for further prosecution. The following information applies to fisheries law enforcement cases initiated in MARSEC:

	FF/V NAME/FLAG	DATE	EEZ Violated
a.	DON WON NO. 801 (KS)	Mar 95	FSM
b.	HAI HSIANG NO. 68 (TW)	Apr 95	FSM
c.	HAI HSIANG NO. 239 (TW)	Apr 95	FSM
d.	JIN JIANN LIH NO. 22 (TW)	Apr 95	FSM
e.	FONG SEONG NO. 737 (KS)	Jun 95	PNG
f.	FONG SEONG NO. 767 (KS)	Jun 95	PNG/FSM
g.	HL ACHIEVER (KS)	Jun 95	FSM
h.	FONG SEONG NO. 707 (TW)	Jul 95	PNG/FSM
I.	SUBARU II (VC)	Dec 95	PNG

NMFS Patrols

In 1995, NMFS Special Agents (SA) accompanied USCG cutters on several patrols including the CGC JARVIS. The NMFS SA on board the CGC JARVIS was the on scene case agent during the time the CGC JARVIS intercepted the Japanese F/V's MIYOU ZIN MARU NO. 131 and CHOKYU MARU NO. 15. NMFS SA's also accompanied several cutter patrols in the North Pacific on high seas driftnet and salmon enforcement.

The NMFS in coordination with the U. S. State Department, participated in the "ship rider" program. This provided the USCG with assistance with language translation between the CGC RUSH and the FF/V LUYAN BU 6006 which was subsequently seized and towed to Guam in violation of high seas driftnet fishing. Upon the vessel's arrival in Guam, NMFS SA's continued with the investigation which lead to the prosecution of the vessel's Captain.

NMFS Enforcement Activities

In 1995, the Hawaii Office conducted 121 boardings and accompanied three aircraft patrols and one international (Canadian high seas) air patrol. A breakdown of the vessels boarded is as follows: Sixty-three vessels were U. S., 51 were Japanese, one Korean, and six were Taiwanese. Twenty-four of the boardings were offload inspection (see attachment).

The American Samoa Office conducted 34 boardings and conducted one air patrol. Four vessels were U. S., one Japanese, 17 Taiwanese, five Korean, two Panamanian, one Vanavatu, and four Honduran (see attachment).

A total of 56 cases were presented for prosecution for the Hawaii and American Samoa Offices. Thirty-seven cases were investigated under the Magnuson Fisheries Conservation and Management Act (MFCMA), 18 cases were investigated under the Endangered Species Act (ESA), and one case under the Marine Mammal Protection Act (MMPA).

1995 NMFS Boardings Conducted

Honolulu Office:

121 boardings conducted during 1995

60 boardings conducted in accordance with WPP
60 boardings conducted in accordance with FCMA
1 boarding conducted in accordance with SLP

63 U. S. flagged vessels
51 Japan flagged vessels
1 Korean flagged vessel
6 Taiwan flagged vessels

104 type 60 vessels
10 type 3 vessels
2 type 2 vessels
2 type 80 vessels
1 type 98 vessel
2 other

24 offloads checked, all WPP

3 C-130 patrols accompanied
1 P-3 patrol accompanied

Samoa Office

34 boardings conducted

4 U. S. flagged vessels
1 Japanese flagged vessels
17 Taiwanese flagged vessels
5 Korean flagged vessels
2 Panamanian flagged vessels
1 Vanavatu flagged vessel
4 Honduran flagged vessels

All 34 boardings occurred in accordance with FCMA
28 type 60 vessels
3 type 17 vessels
1 type 11 vessel
1 type 50 vessel
1 other

7 offloads checked

1 patrol conducted via Samoa Air Charter

1995 NMFS Honolulu and Samoa Statistics

No. of Cases: 56

WPP Cases: 33

13 cases, no permit
5 cases,logs
2 cases, observer
5 cases, failure to notify
4 cases, fishing in prohibited area
1 case, transferring permit
3 cases, fishing in protected species zone

ES Cases: 18

MM Cases: 1

FCMA: 4

Two cases from the CGC JARVIS (SA Querin, Case Agent)

Appendix 1

Territory of American Samoa

Introduction

The pelagic fishery in American Samoa has historically been an important component of the traditional fishery. The fishery was first monitored in the mid 1970s and has operated on a similar, small scale since that time. Prior to 1985, only commercial landings were monitored. From October 1985 to the present, data were collected through a creel survey that included subsistence and recreational fishing as well as commercial fishing. The island of Tutuila is also a major base for the trans-shipment and processing of tuna taken by the high-seas longline and purse seine fleets. The domestic pelagic fishery is monitored by the Department of Marine and Wildlife Resources (DMWR), through a program established in conjunction with the Western Pacific Fishery Information Network. This report was prepared by DMWR using information obtained by surveying pelagic fishing activities throughout the year. It does not contain information from tournament catches. This report partially fulfills the national standard requirement for a Stock Assessment and Fishery Evaluation (SAFE) report.

Summary

During 1995, most indicators showed continued increases in landings and effort. The estimated number of trips increased from 1,738 in 1993 to 2,476 in 1995. Since catch per unit effort (CPUE) was similar to previous years for all species, landings increased accordingly: However, it appears that some of this increase in landings and effort is in large part due to chronic underestimation of participation in the fishery during past years. Improved supervision of data collectors during 1994 resulted in substantially larger estimates of daily participation on creel survey days. This caused a corresponding increase in estimated landings for the second half of 1994 and all of 1995. 1994 and 1995 estimates of catch and effort are more accurate than those from many past years. Thus, caution must be used when comparing them with past years.

Catch of albacore increased dramatically in 1995. During the last half of the year, four boat owners equipped existing fishing vessels with monofilament longline gear. These vessels have been targeting albacore for the cannery market and have caused the albacore harvest to increase from less than 2,000 pounds in 1994 to over 50,000 pounds in 1995. If this trend continues, albacore landings will surpass yellowfin tuna in 1996.

The pelagic fishery encounters competition from a supply of frozen fish purchased or bartered from foreign longline vessels moored in Pago Pago Harbor. Poor documentation of these transactions makes it difficult to assess the impact of these exchanges on the market for fresh fish that are supplied by local fishermen. Imports of pelagic fish through regular channels are not currently an important source of competition with the local fishery. The market share of imported pelagic species declined from 66% in 1990 to 20% in 1991 to less than 5% in 1995.

Recommendations

1) Continue efforts to monitor the pelagic fisheries of the local fleet in American Samoa.

2) Continue efforts to quantify the amount of fish being imported from foreign longline vessels and to what extent this supply impacts the local fishery. [See appended report on "leakage" of fish from distant water fleets into the local market, which fulfills a previous recommendation.]

3) Closely monitor the emerging monofilament long line fishery.

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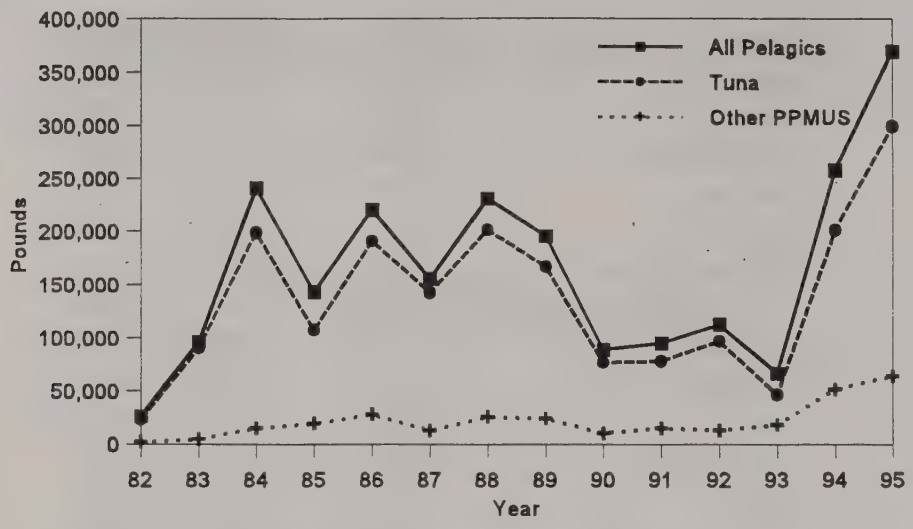
Table 1. American Samoa 1995 estimated total pelagics landings by all gear.

Species	Pounds
Skipjack Tuna	179,691
Albacore	54,902
Yellowfin Tuna	60,920
Kawakawa	379
Bigeye Tuna	5,171
Unidentified Tunas	336
Subtotal Tunas	**301,400**
Mahimahi	12,122
Blue Marlin	26,262
Wahoo	12,796
Dogtooth Tuna	1,289
Sharks	6,474
Sailfish	6,184
Subtotal other PPMUS	**65,133**
Barracuda	3,515
Rainbow Runner	2,763
Unidentified	21
Subtotal Misc.	**6,299**
Total Pelagics	**372,832**

Table 2. American Samoa 1995 commercial landings, value and average price of pelagic species.

Species	Pounds	$/lb	Value ($)
Skipjack Tuna	176,136	0.77	135,625
Albacore	54,902	1.74	95,529
Yellowfin Tuna	56,985	1.30	74,081
Kawakawa	379	0.81	307
Bigeye Tuna	5,171	1.02	5,274
Unidentified Tunas	336	1.38	464
Subtotal Tunas	**293,909**	**1.06**	**311,280**
Mahimahi	11,018	2.19	24,129
Blue Marlin	25,120	0.99	24,869
Wahoo	12,013	1.57	18,860
Dogtooth Tuna	1,289	1.95	2,514
Sharks	623	1.70	1,059
Sailfish	5,841	1.28	7,476
Subtotal other PPMUS	**55,904**	**1.41**	**78,908**
Barracudas	3,507	1.68	5,808
Rainbow Runner	2,381	1.91	5,222
Unidentified	21	1.00	21
Subtotal Misc.	**5,909**	**1.87**	**11,051**
Total Pelagics	**355,722**	**1.13**	401,239

Figure 1. American Samoa total annual landings: all pelagics, tuna and other PPMUS.



	Pounds Landed		
Year	**All Pelagics**	**Tuna**	**Other PPMUS**
1982	26,396	23,042	2,106
1983	96,318	90,057	4,806
1984	241,099	198,961	15,121
1985	143,212	107,656	19,686
1986	220,063	190,621	28,046
1987	155,324	142,155	12,798
1988	230,951	201,404	25,972
1989	195,563	166,922	24,253
1990	89,240	77,213	10,288
1991	95,009	78,033	15,129
1992	112,431	96,701	13,054
1993	67,037	46,757	18,498
1994	257,859	201,097	51,672
1995	**372,832**	**301,400**	**65,133**
Average	**164,524**	**137,287**	**21,897**

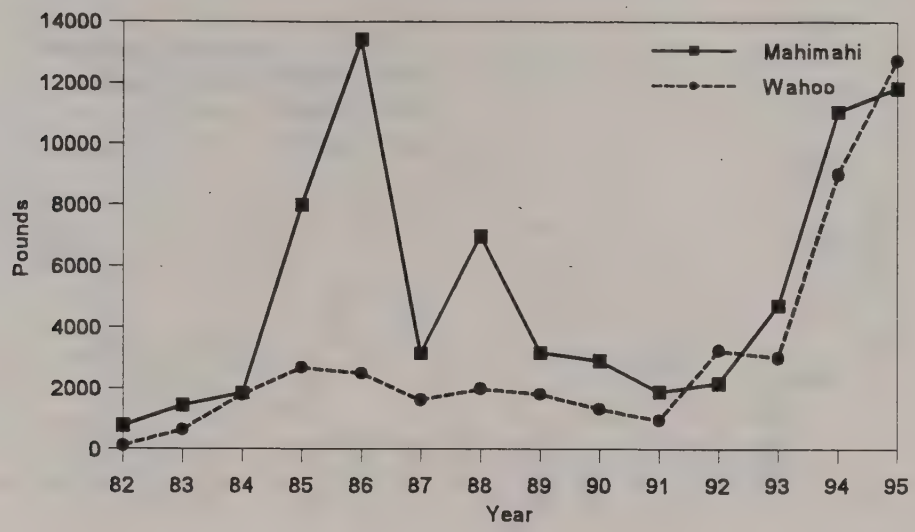
Calculation

Estimated landings for tuna and other PPMUS were calculated by summing the total landings for the species in each category. Estimated landings for all pelagics represent the sum of tuna and other PPMUS plus landings from the miscellaneous category (see Table 1). These figures include both commercial and recreational/subsistence components of the fishery.

Interpretation

Estimated landings increased by 43% in 1995. Much of this increase appears to be due to improved sampling that began in mid 1994. However, a portion of the increase is probably real since there was a ten percent increase in the number of boats participating in the fishery (Figure 6), and albacore landings increased dramatically due to increased longline effort.

Figure 2. American Samoa annual landings: mahimahi and wahoo.

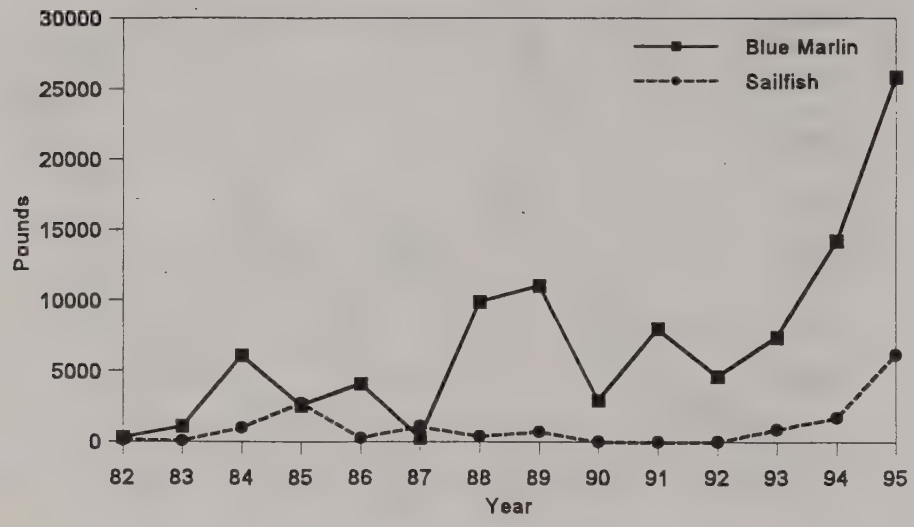


	Pounds Landed	
Year	**Mahimahi**	**Wahoo**
1982	777	114
1983	1,443	632
1984	1,844	1,777
1985	8,011	2,678
1986	13,435	2,492
1987	3,144	1,609
1988	6,976	1,981
1989	3,179	1,804
1990	2,913	1,320
1991	1,890	952
1992	2,174	3,244
1993	4,722	3,007
1994	11,048	9,000
1995	**12,122**	**12,796**
Average	**5,263**	**3,100**

Calculation
The estimated total landings for mahimahi and wahoo are summed for all fishing methods.

Interpretation
Mahimahi landings have been variable across time. Reasons for this variability are unknown, but similar fluctuations appear to occur in other parts of the WPACFIN region. From 1984 to 1988, when American Samoan fishermen exported mahimahi to Hawaii, landings were unusually high. 1995 landings are the largest since that time. Wahoo landings have been more stable across time, but have increased dramatically during the last two years.

Figure 3. American Samoa total annual landings: blue marlin and sailfish.



	Pounds Landed	
Year	**Blue Marlin**	**Sailfish**
1982	315	127
1983	1,083	74
1984	6,097	989
1985	2,574	2,744
1986	4,108	271
1987	297	1,081
1988	9,892	367
1989	11,047	687
1990	2,946	0
1991	8,012	0
1992	4,628	0
1993	7,404	873
1994	14,223	1,705
1995	26,268	6,184
Average	**7,063**	**1,079**

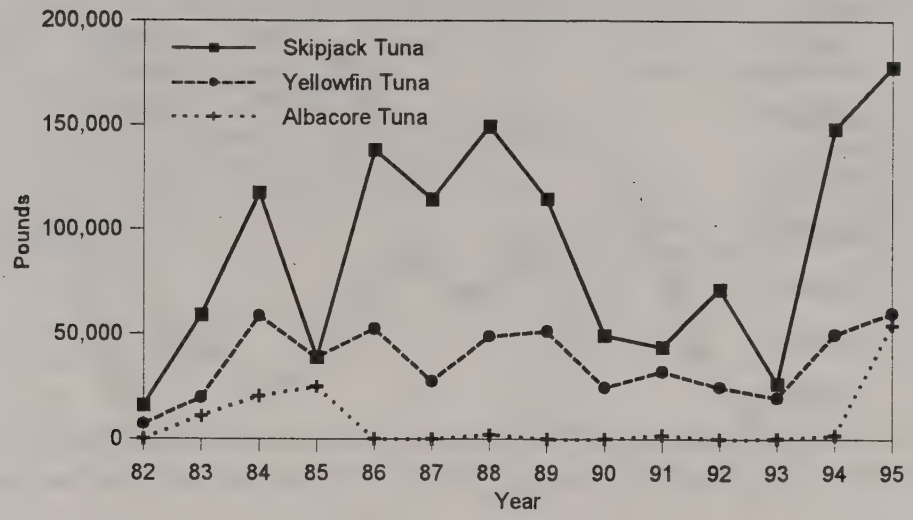
Calculation

The estimated total yearly landings of blue marlin and sailfish are summed for all fishing methods.

Interpretation

Dramatic increases in blue marlin and sailfish landings for 1995 are probably due to in part to improved assessment of fishery participation. Marlin and sailfish are also taken incidentally while longlining, and part of the increased landings are due to increased longline fishing during 1995.

Figure 4. American Samoa total annual landings: skipjack, albacore and yellowfin tuna.



	Pounds Landed						
Year	**Skipjack**	**Yellowfin**	**Albacore**	**Year**	**Skipjack**	**Yellowfin**	**Albacore**
1982	15,877	7,038	0	1989	114,805	51,383	0
1983	58,997	19,789	10,904	1990	49,613	24,565	0
1984	117,693	58,704	20,390	1991	43,888	32,225	1,672
1985	38,902	38,586	24,821	1992	71,677	24,722	0
1986	138,064	52,464	0	1993	26,616	19,775	236
1987	114,381	27,627	0	1994	148,382	50,124	1,802
1988	149,416	49,153	1,884	**1995**	**179,691**	**60,920**	**54,902**
				Average	**90,572**	**36,934**	**8,329**

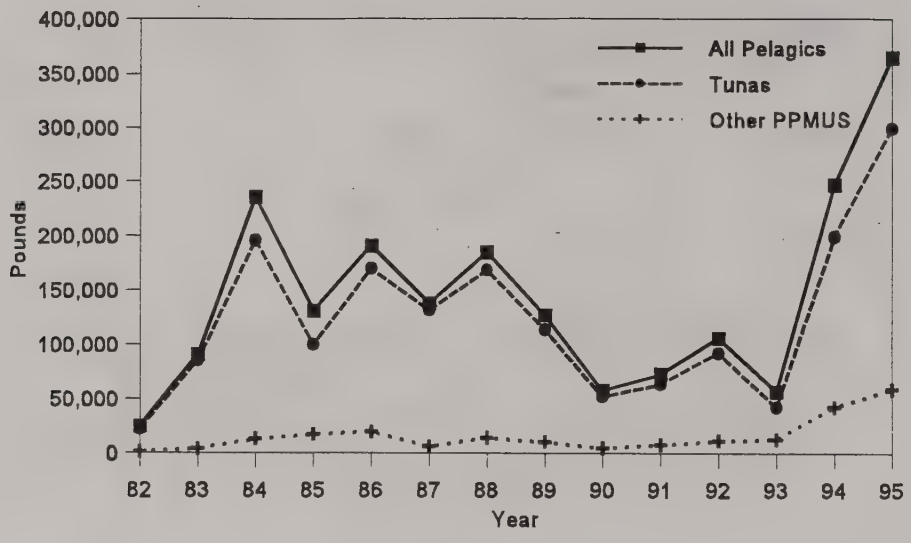
Calculation

The estimated yearly total landings of skipjack, yellowfin and albacore tuna are summed for all fishing methods.

Interpretation

Apparent increases in yellowfin and skipjack landings are probably due to improved assessment of fishery participation and actual landings are probably similar to previous years Dramatically increased albacore landings are due to a sudden increase in Hawaiian style monofilament longlining that began in July and August. Prior to that time, albacore was taken at very low levels during occasional vertical longlining trips. The comparatively large albacore landings during 1983 through 1985 were the result of experimental fishing by the Department of Marine and Wildlife Resources vessel. No albacore was recorded as having been taken by private vessels during those years.

Figure 5. American Samoa annual commercial landings: all pelagic species, tunas and other PPMUS.



	Pounds Landed		
Year	**All Pelagics**	**Tunas**	**Other PPMUS**
1982	24,820	22,065	1,515
1983	90,744	85,069	4,441
1984	236,216	196,100	13,458
1985	131,310	99,987	17,515
1986	190,998	169,986	19,949
1987	137,925	131,457	6,305
1988	185,432	168,826	14,210
1989	127,560	113,904	10,745
1990	58,089	52,111	4,903
1991	73,044	63,607	8,096
1992	106,299	92,381	11,759
1993	57,184	42,573	12,945
1994	247,347	199,681	42,589
1995	355,722	293,909	55,904
Average	**144,478**	**123,909**	**16,024**

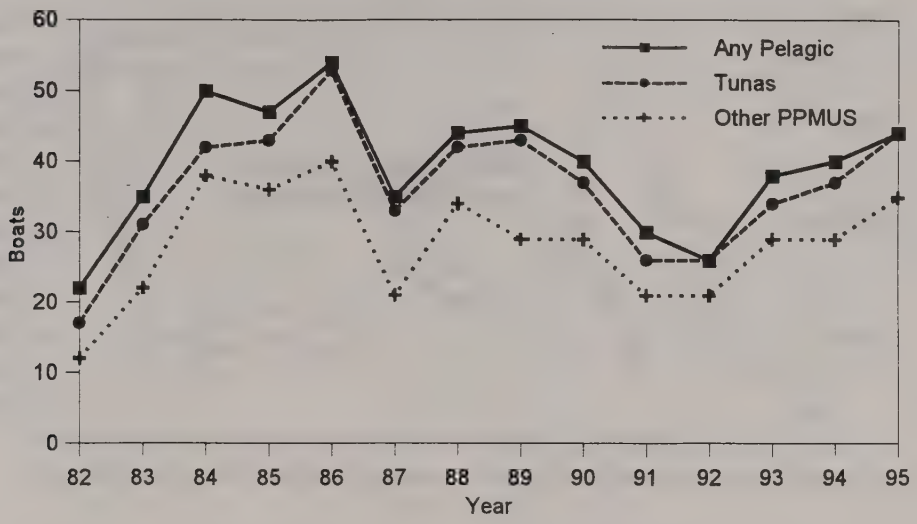
Calculation

Estimated commercial landings for tunas and other PPMUS were calculated by summing commercial landings for the species in each category. Estimated landings for all pelagics represent the sum of tunas and other PPMUS plus landings for the miscellaneous category (see Table 1).

Interpretation

Commercial landings represent the vast majority of landings for pelagic species, thus Figure 5 and Figure 1 are virtually identical. Much of the increase in pelagic landings for 1995 is probably due to chronic underestimation of participation prior to mid 1994.

Figure 6. Number of American Samoa boats landing any pelagic species, tunas and other PPMUS.



	Number of Boats landing:		
Year	**Any Pelagic**	**Tunas**	**Other PPMUS**
1982	22	17	12
1983	35	31	22
1984	50	42	38
1985	47	43	36
1986	54	53	40
1987	35	33	21
1988	44	42	34
1989	45	43	29
1990	40	37	29
1991	30	26	21
1992	26	26	21
1993	38	34	29
1994	40	37	29
1995	**44**	**44**	**35**
Average	**39**	**36**	**28**

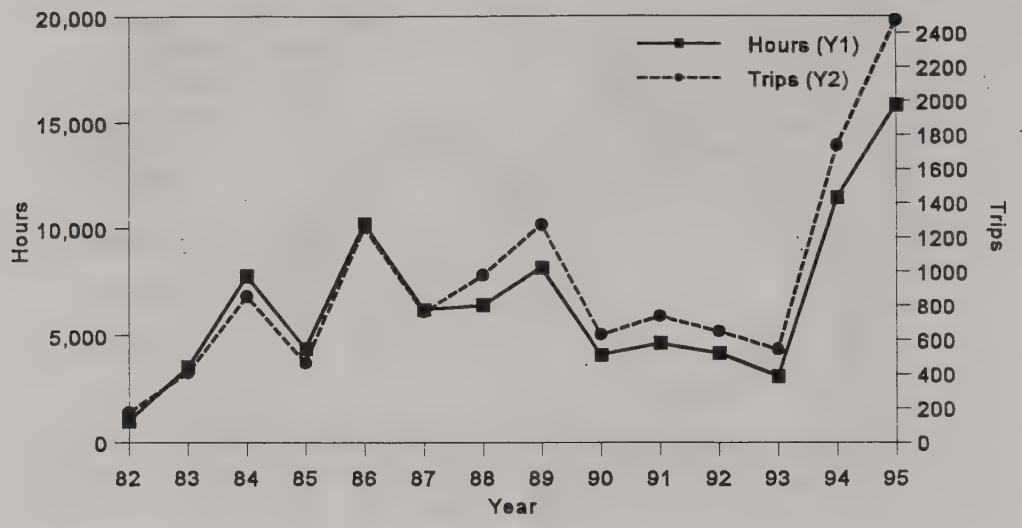
Calculation

The sampling program is extensive enough, and the number of boats small enough, to use the raw database counts of the number of unique vessels in a given year. When data are collected, the vessel is always identified. Each boat counted in the above table made at least one recorded landing of at least one pelagic species during a given year.

Interpretation

The number of boats participating in the pelagic fishery increased by ten percent in 1995. As in past years, a small number of "highliners" dominate the pelagic fishery, with 34% of the boats being responsible for landing 80% of the pelagic catch.

Figure 7. American Samoa fishing effort for pelagic species (trolling only).



Estimated Trolling Effort

Year	Hours	Trips	Year	Hours	Trips
1982	1,019	177	1989	8,177	1,273
1983	3,513	406	1990	4,103	631
1984	7,785	853	1991	4,656	739
1985	4,394	464	1992	4,178	650
1986	10240	1,259	1993	3,103	545
1987	6,218	764	1994	11,453	1,738
1988	6421	978	1995	15,960	2,496
			Average	**6,516**	**927**

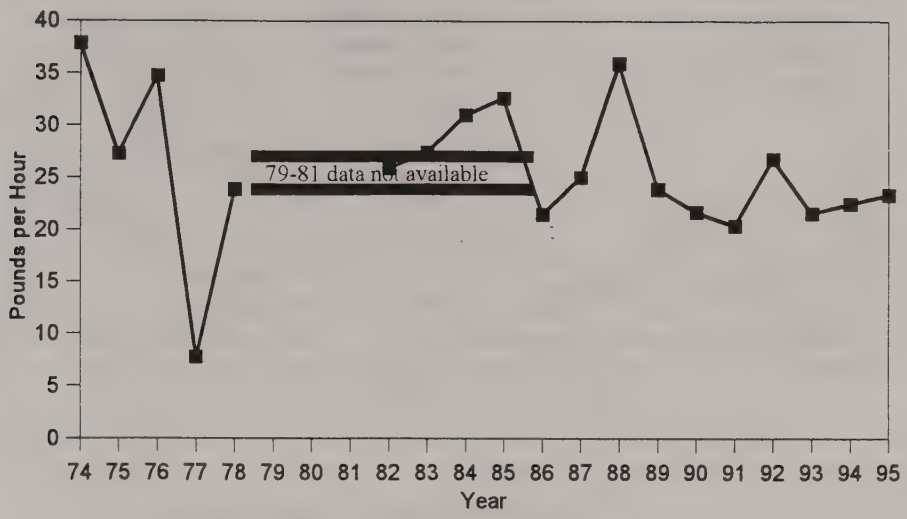
Calculation

Estimated total annual landings are used as a base for estimating trolling effort. The estimated total longlining landings are subtracted from the total landings, and the resultant number is divided by the average trolling catch per hour (CPUE) to give an estimate of the hours trolled. Trolling CPUE is calculated using only those trips where trolling was the only method used, and for which the number of hours was recorded. The number of trips is calculated by dividing the estimated total hours of effort by the average length of a trolling trip.

Interpretation

Fishing effort increased by almost 50% in 1995. Much of this increase is probably illusory and is due to underestimation of participation prior to mid 1994. Trips averaged 6.5 hours in length, somewhat shorter than in previous years.

Figure 8. American Samoa overall pelagic catch per hour trolling.



Year	Lb/Hr	Trips	Year	Lb/Hr	Trips
1974	37.9	31	1987	25.0	217
1975	27.3	98	1988	36.0	284
1976	34.8	10	1989	23.9	373
1977	7.8	6	1990	21.7	287
1978	23.9	96	1991	20.4	211
1982	25.9	104	1992	26.8	204
1983	27.4	156	1993	21.6	220
1984	31.0	311	1994	22.5	388
1985	32.6	193	1995	23.4	484
1986	21.5	401	**Average**	**26.2**	**188**

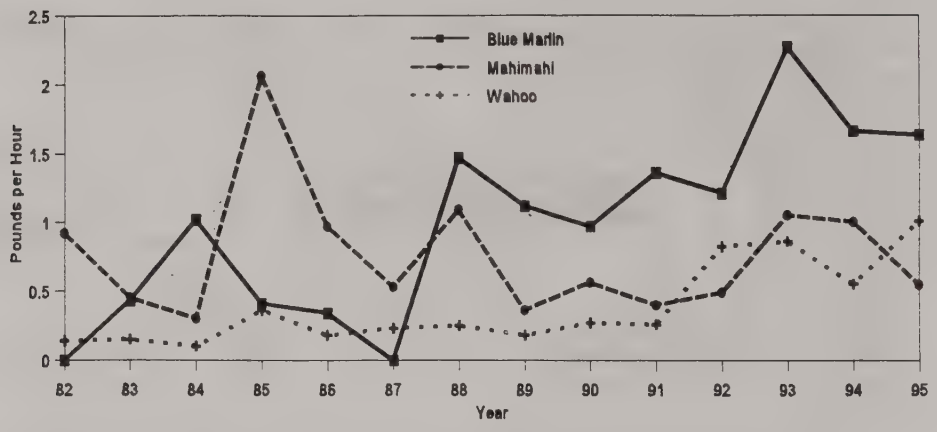
Calculation

For trips where trolling was used exclusively, and where effort was recorded, the total catch was divided by the total number of trolling hours to obtain CPUE. Data are from three sources; 1974-78 are from the Dory Project, 1982-84 are from the commercial catch monitoring system, and 1985-94 are from the creel survey program.

Interpretation

Total pelagic species CPUE is predominantly the combined skipjack and yellowfin CPUE shown in Figure 10, as these two species contribute more than 85% of the total troll catch. 1995 CPUE was slightly higher than 1994 due to increased CPUE for skipjack tuna. Pelagic species CPUE has been variable, especially in the early years of the American Samoa troll fishery. Low CPUE in 1977 is possibly due to small sample sizes and other data collection problems.

Figure 9. American Samoa trolling catch rates: blue marlin, mahimahi and wahoo.



	Pounds Caught per Hour Trolling		
Year	**Blue Marlin**	**Mahimahi**	**Wahoo**
1982	0.00	0.92	0.14
1983	0.43	0.45	0.15
1984	1.02	0.30	0.10
1985	0.41	2.06	0.36
1986	0.34	0.97	0.18
1987	0.00	0.53	0.23
1988	1.47	1.09	0.25
1989	1.12	0.36	0.18
1990	0.97	0.56	0.27
1991	1.36	0.40	0.26
1992	1.21	0.49	0.82
1993	2.27	1.05	0.86
1994	1.66	1.00	0.55
1995	1.63	0.55	1.01
Average	**0.99**	**0.77**	**0.38**

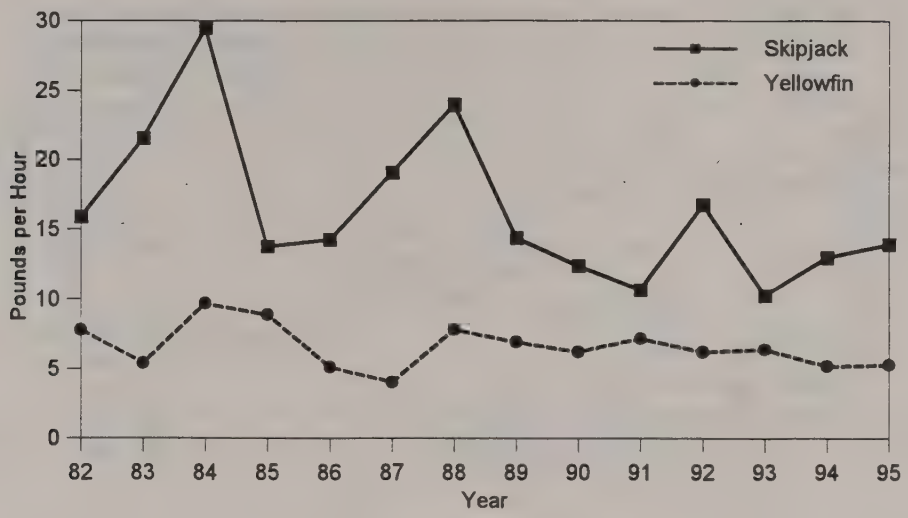
Calculation

For trips where trolling was used exclusively, and where effort was recorded, the total catch by species was divided by the total number of trolling hours to obtain CPUE.

Interpretation

Blue marlin CPUE is highly variable but has shown a gradual increase across time. The high variability is probably due to small number of individual fish taken, while the overall increase in CPUE is probably due to gear and boat improvements that have allowed fishermen to successfully harvest these large fish. Mahimahi CPUE peaked in the mid eighties, when an export market existed for this species. Since that time, mahimahi CPUE has been variable, but without obvious trend. Wahoo CPUE has also increased across time and reached its maximum in 1995. The reason for this increase is unknown.

Figure 10. American Samoa trolling catch rates: skipjack and yellowfin tuna.



	Pounds Caught Per Hour Trolling	
Year	**Skipjack**	**Yellowfin**
1982	15.9	7.8
1983	21.6	5.4
1984	29.5	9.7
1985	13.8	8.9
1986	14.3	5.1
1987	19.1	4.0
1988	24.0	7.8
1989	14.4	6.9
1990	12.4	6.2
1991	10.7	7.2
1992	16.8	6.2
1993	10.3	6.4
1994	13.0	5.2
1995	14.0	5.3
Average	**16.41**	**6.58**

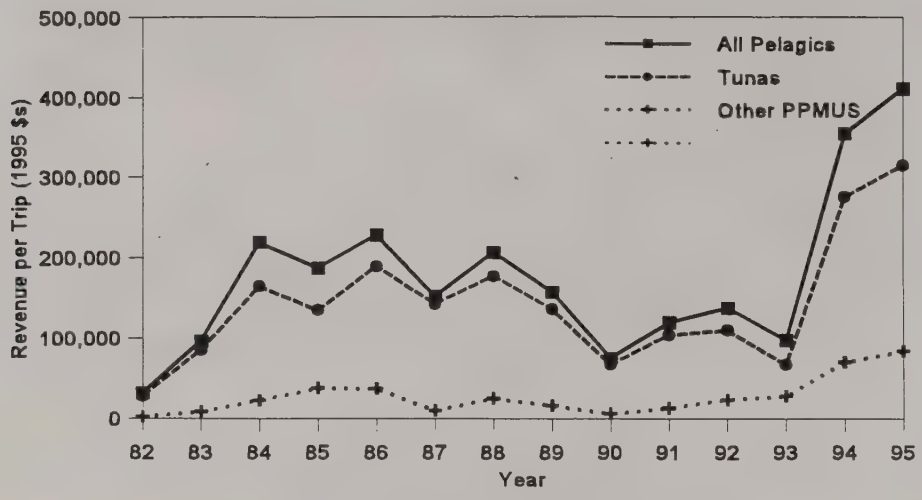
Calculation

For trips where trolling was used exclusively, and where effort was recorded, the total catch by species was divided by the total number of trolling hours to obtain CPUE.

Interpretation

Both skipjack and yellowfin CPUE have been highly variable through the years. In spite of this variability, a declining trend is apparent in CPUE for both species.

Figure 11. American Samoa annual inflation-adjusted revenue for commercially landed pelagic species.



	Revenue ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	21,824	32,081	18,990	27,915	1,534	2,255
1983	66,254	96,731	58,561	85,499	5,828	8,509
1984	153,571	219,607	11,498	164,423	15,938	22,791
1985	131,961	187,385	95,157	135,122	26,800	38,056
1986	166,851	228,585	138,498	189,742	27,311	37,416
1987	116,564	152,699	108,816	142,548	7,527	9,860
1988	163,189	207,250	139,902	177,675	19,940	25,323
1989	129,460	157,941	111,923	136,546	13,269	16,188
1990	66,865	75,557	59,747	67,514	5,554	6,276
1991	110,275	120,200	95,936	104,570	12,083	13,171
1992	132,899	138,215	106,260	110,510	22,629	23,534
1993	94,707	98,495	64,890	67,485	27,113	28,197
1994	348,401	355,369	271,170	276,593	68,993	70,372
1995	**401,239**	**401,239**	**311,280**	**311,280**	**78,908**	**78,908**
Average	**150,290**	**176,525**	**113,759**	**142,673**	**23,816**	**27,204**

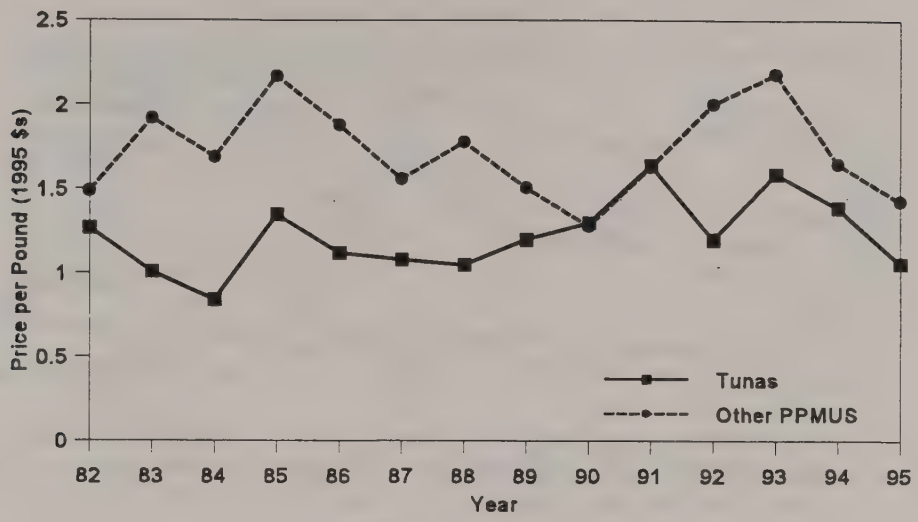
Calculation

Revenues from commercial landings for all pelagic species are adjusted for inflation by multiplying a given year's revenue by the quotient of the 1995 consumer price index (CPI) divided by the CPI for that year.

Interpretation

Sharp increases in revenue from pelagic landings are in great part due to chronic underestimation of landings in past years. Fishermen actually received less per pound for tunas and other PPMUS in 1995 than in 1993 or 1994 (Figure 12).

Figure 12. American Samoa average price for tunas and other PPMUS.



	Average Price ($/lb)			
	Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	0.86	1.27	1.01	1.49
1983	0.69	1.01	1.31	1.92
1984	0.59	0.84	1.18	1.69
1985	0.95	1.35	1.53	2.17
1986	0.81	1.12	1.37	1.88
1987	0.83	1.08	1.19	1.56
1988	0.83	1.05	1.40	1.78
1989	0.98	1.20	1.23	1.51
1990	1.15	1.30	1.13	1.28
1991	1.51	1.64	1.49	1.63
1992	1.15	1.20	1.92	2.00
1993	1.52	1.59	2.09	2.18
1994	1.36	1.39	1.62	1.65
1995	1.06	1.06	1.41	1.41
Average	**1.02**	**1.22**	**1.42**	**1.75**

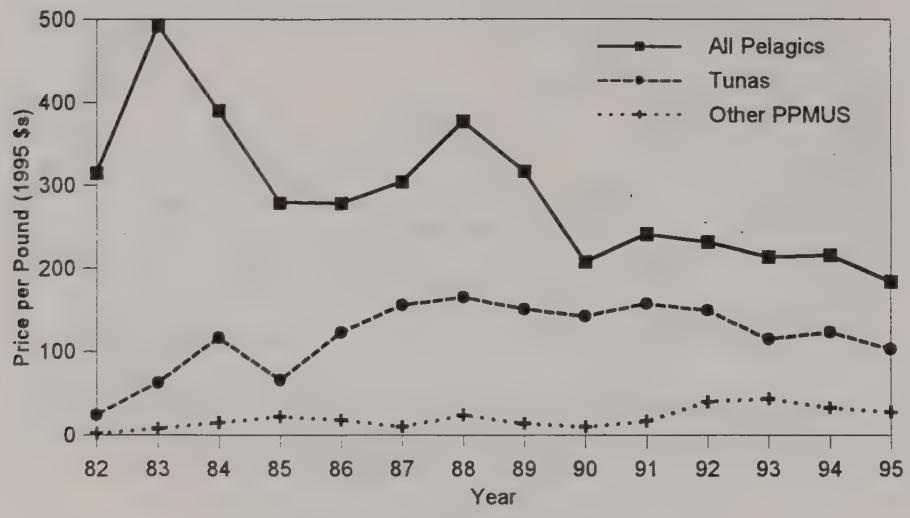
Calculation

The average price per pound for each year is calculated by dividing the estimated revenue by the estimated weight sold. The adjustment for inflation is made by multiplying the annual average price for a given year by the 1995 consumer price index (CPI) for American Samoa, and dividing by the CPI for the given year.

Interpretation

Prices for both tuna and other PPMUS declined in 1995. Prices for pelagic species remain low because of competition from frozen fish purchased from foreign longline vessels moored in Pago Harbor.

Figure 13. American Samoa average inflation-adjusted per trip revenue for trips landing PPMUS.



	Revenue per trip ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjust.	Adjusted	Unadjust.	Adjusted	Unadjust.	Adjusted
1982	214	315	16	24	1	2
1983	338	493	43	63	5	8
1984	274	391	82	117	11	15
1985	196	279	47	66	16	22
1986	203	278	90	123	14	18
1987	232	304	119	156	8	10
1988	297	377	130	165	19	24
1989	260	317	124	151	12	14
1990	184	208	126	143	9	10
1991	221	241	145	158	15	17
1992	223	232	144	150	38	40
1993	206	214	111	116	42	44
1994	212	216	122	124	33	33
1995	185	185	104	104	28	28
Average	**232**	**289**	**100**	**119**	**18**	**20**

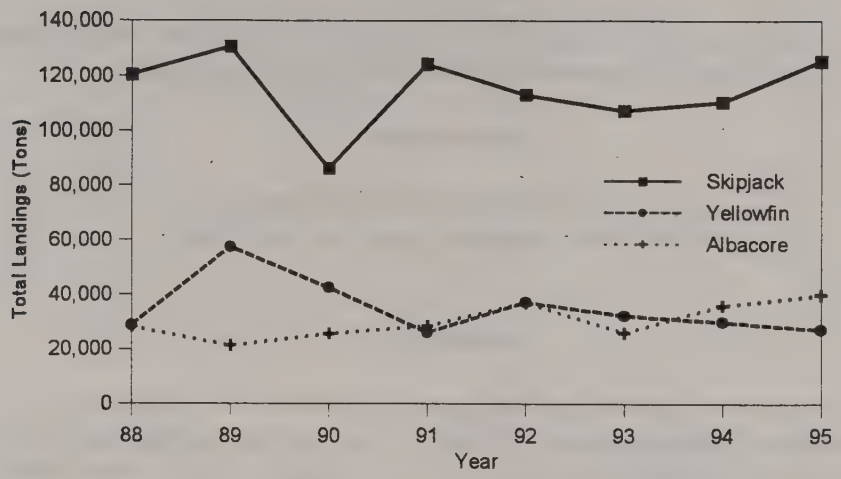
Calculation

For commercial trips where pelagic species were landed, the average revenue per trip was calculated for each category. Revenue was adjusted for inflation by multiplying it by the quotient of the 1995 CPI divided by the respective years' CPI.

Interpretation

Revenue per trip continued to decline in 1995. In spite of slight increases in CPUE, declining ex-vessel prices resulted in an overall decline in per trip revenue.

Figure 14. Total cannery landings for skipjack, yellowfin and Albacore tuna



	Short Tons landed		
Year	**Skipjack**	**Yellowfin**	**Albacore**
1988	120,500	28,800	28,200
1989	130,800	57,500	21,400
1990	86,300	42,600	25,700
1991	124,400	26,200	28,500
1992	113,200	37,200	36,900
1993	107,400	32,200	26,000
1994	110,500	30,100	36,000
1995	**125,300**	**27,300**	**40,000**
Average	**114,800**	**35,238**	**30,338**

Calculation

Cannery landings are from monthly landings summaries supplied by the canneries.

Interpretation

The quantity of fish landed at American Samoa's canneries exceeds local landings by a factor of a thousand. Though some locally caught pelagics, especially albacore, are sold to the canneries, the vast majority of the fish landed have been taken in distant water fisheries. Cannery landings have remained essentially stable for the last five years, though albacore landings have increased across time.

Appendix 1A

A preliminary analysis of the quantity of "leakage" fish entering American Samoa during 1995 and their economic impact.

Alan Kinsolving

Department of Marine and Wildlife Resources
Box 3730, Pago Pago, American Samoa 96799

Introduction

During 1995, approximately 195,000 tons of pelagic fish were landed in American Samoa by the high-seas purse seine and longline fleet and processed by the two canneries located on Tutuila Island (DMWR, 1996). The local fishing fleet, on the other hand, landed only 185 tons of pelagic fish during 1995, most of which was sold locally (Western Pacific Regional Fishery Management Council, 1996). The vast majority of the fish landed by the high seas fleet are sent directly to the canneries for processing and export and do not enter the local market as fresh or frozen fish. However, a small percentage of the high seas landings "leak" into the local market where they compete directly with fish landed by domestic fishermen.

Traditionally, fish leaked into the local market primarily from Taiwanese and Korean longline vessels. Prior to off-loading, the crew would trade by catch species such as wahoo and marlin to local middle men for liquor, bananas, or small amounts of cash. The middle men would then sell the fish to local stores and restaurants. Most of these transactions took place surreptitiously, since in many cases the ships captain was not informed. Also, though not expressly prohibited by local law, the trade in leakage fish was discouraged by the government. Thus, it has been difficult to accurately quantify the amount of leakage from the high-seas fleet because of the covert nature of the activity.
Recently, the trade in leakage fish has become more organized and less covert. The trade is now dominated by several large volume operators who purchase fish directly from vessel captains and operate during day time hours.

Most of the large operators that now dominate the leakage fish trade have obtained transshipment permits, issued by National Marine Fisheries Service (NMFS) and are submitting regular reports. This, coupled with improvements in the Department of Marine Resources (DMWR) invoice collection system, have allowed an accurate estimation of fish leakage for 1995.

Methods

The amount of leakage fish entering American Samoa was assessed using transshipment reports obtained from NMFS coupled with a very crude estimate of the amount of leakage from non-permitted sources. The impact of the leakage fish on the local market was assessed using

DMWR's point of purchase invoice system.

In order to legally move fish from a foreign-flag fishing vessel to another motorized vessel in US. waters, the receiving vessel must obtain a transshipment permit from NMFS. Within 72 hours of receiving fish, the permittee must report the quantity and species of fish moved. Though this law was primarily designed to track the transshipment of large volumes of fish to refrigerated container ships, the NMFS office in American Samoa, in cooperation with DMWR, began requiring small boats to obtain the permits as well. The first small vessel obtained its permit in January of 1995. By March of 1995, all of the large operators had obtained permits. However, small operators continue to move fish covertly and have failed to obtain permits. Fish are also moved directly from longliners to shore or to non-motorized vessels. These transactions do not need to be reported to NMFS. Further, most of the permitted transshipment vessels did not reliably report their transshipment activity. Thus, the NMFS transshipment reports underestimate the total volume of fish leaking from the high seas fleet.

To estimate the amount of non-reported leakage fish, an observer was stationed either on the DMWR dock or on another vessel in the harbor where most or all longline vessels could be clearly seen. The observer counted the number of unpermitted vessels or individuals seen moving fish, and attempted to visually estimate the number and weight of fish moved on each occasion. Vessels that had applied for a transshipment permit were not counted. Unfortunately, none of the vessels that had applied for a permit submitted any transshipment reports until February. Because the fish being moved were frequently not examined closely, the estimated weights are suspect. No attempt was made to interview the operators because, especially at night, it was felt to be unsafe. We also did not wish the operators to know we were present, because it might have caused them to hide their activities further. Observers spent 8 hours per day observing transactions. No attempt was made to randomize observation dates, rather we attempted to observe approximately equally on weekdays, weekends, night and day. A total of 15 observation days took place between January, 1995 and early April 1995.

All stores and restaurants that purchase fish in American Samoa are required to complete an invoice detailing the species and quantity of fish purchased, the price paid and the source of the fish. DMWR staff attempt to make monthly contact with each business to pick up completed invoices and distribute new invoice books. Beginning in mid 1994, DMWR began prosecuting vendors that did not cooperate with the invoice collection program. This resulted in a dramatic increase in the number of invoices completed. However, because of the large number of stores and restaurants that occasionally purchase fish, the program has failed to get cooperation from all businesses.

A total of 2,279 invoices detailing the purchase of 254, 669 pounds of fish were submitted by 37 vendors for 1995. Of these, 796 invoices, or 35% involved the purchase of Pacific Pelagic Management Unit Species (PPMUS). These invoices were used to estimate the approximate impact of leakage fish on local markets.

Results

Transshipment Permits

Transshipment reports were summarized both by NMFS and by DMWR. Because it is possible that some reports were not seen by DMWR prior to being sent to NMFS, it is possible that the summaries differ slightly.

A total of 61,442 pounds of fish were officially transshipped by small boats during 1995. The quantity transshipped was highly variable, with a high of 19,000 pounds moved during March to a low of zero moved during August and September. At this time it is not known whether this variability is due to changing patterns of demand, the number of longliners in the harbor or poor compliance with reporting requirements.

During the first third of 1995, when fish movement activity was being monitored closely, it appeared that several of the permitted transshipment were not reporting their activities, especially during January and February. Thus, the figure of 61,442 pounds moved is probably an underestimate.

Wahoo accounted for 51% of the pounds moved, followed by mahimahi (13%), bigeye tuna (10%), swordfish (9%), marlin (3%), Sailfish (3%) and yellowfin tuna (2%). Other species accounted for the remaining 9%.

Unreported leakage fish

The amount of unpermitted leakage fish moved was highly variable (Table 1.). On most shifts, between one and three vessels were seen moving fish. However, on January 7, 23 individuals were counted. All of these were working loading fish onto a refrigerated container ship anchored in the harbor. Apparently, they were all taking at least one fish when the shift changed. Since that time, I have not noticed a similar event and would assume it is not a common occurrence. Because of that, I did not use that date for further analysis.

Most fish were moved from longliners to small motorized vessels. Movement of fish took place primarily during mid morning and late in the evening, with no fish being moved during the late night/early morning period. The majority of fish moved were wahoo and yellowfin or bigeye tuna. Moonfish, skipjack tuna and marlin were each seen on one occasion.

Unpermitted leakage data were expanded to give an estimate of annual unpermitted leakage. The day, evening and night averages were each multiplied by 365 and summed. This resulted in an annual estimate of 151,840 ± 60,590 pounds per year. Because the data are so variable and sampling was so limited, the estimate is probably quite suspect.

Point of purchase invoices

A total of 796 invoices from 17 stores and 11 restaurants were analyzed. The invoices detailed

the purchase of 13 types of pelagic fish. Species that were reported less than ten times were merged into larger categories. Unidentified troll fish, sail fish, rainbow runner and dogtooth tuna were called "Other PPMUS". Unidentified tuna, albacore tuna and bigeye tuna were merged as "Other Tuna". This resulted in a total of 8 fish types (Table 2).

Approximately equal quantities of leakage and local fish appear to be sold in the market (Table 3). The restaurant market sells somewhat more leakage fish, with 59% of the total pounds sold originating from the canneries. Whereas the retail market sells somewhat more local fish, with 58% of the pounds sold originating from local sources.

With the exception of marlin, fish from local sources fetched significantly higher prices than leakage fish (a = .05, T test) (Table 4). This was especially true in the restaurant market for yellowfin tuna and mahimahi. restaurants and stores differed significantly both in terms of price paid for fish (a = .05, T test) and species purchased (a = .05, Chi squared test). Because the prices paid for local fish were higher overall, the total value of local fish sold was greater than the total value of leakage fish sold by 10% (Table 5).

The ratio of different species of leakage fish species sold in the market was similar to the ratio of different species of fish species reported on transshipment reports (Table 3). Wahoo were by far the most frequently sold as well as transshipped. Marlin appeared much more frequently in the market than transshipment reports would indicate that they should, as did yellowfin tuna. It is probable that merchants report bigeye tuna as yellowfin since bigeye are not commonly taken in local waters and merchants would not be familiar with the species. Since 12% of pounds transshipped were bigeye or yellowfin tuna, and 11% of the leakage pounds reported were yellowfin tuna, this is probably what is occurring. For locally caught fish, yellowfin tuna and mahimahi were relatively more abundant in the market than in the local catch (Western Pacific Regional Fishery Management Council, 1996) and skipjack tuna were considerably less abundant. Locally caught mahimahi and yellowfin commanded the highest price , and skipjack tuna the lowest average price of all locally caught pelagics. Since fishermen are most likely to sell high value species and keep low value ones, this makes sense.

Conclusions

It would appear that leakage fish from the cannery has a large impact on the local market. Both the estimate of total leakage and the local point of purchase invoice system would indicate that about half of the locally sold fish originate as cannery leakage. Leakage fish probably depress the ex-vessel price paid for pelagic fish to the point where it is only marginally economically feasible to target pelagic species. Though the average price paid for all pelagics was $1.79 per pound, the average price paid for skipjack tuna, which dominate the pelagic harvest, was only $0.78 per pound. Fishermen receive high prices only for those species that fill a need that leakage fish cannot, such as for fresh sashimi grade tuna.

The impacts are, of course, not all negative. Because of leakage fish, consumers have ready access to fish at low prices. If they were forced to depend strictly on local supply, they would be forced to pay higher prices and frequently do without. The quality of fish leaking from foreign longliners is generally high and the product is consistently available. Thus, local vendors that purchase leakage fish can generally count on obtaining a reasonably high quality product at a low price. Most of the small restaurant owners that I have spoken with have indicated that they prefer

to buy leakage fish for lower value menu items (i.e. fish sandwiches and fish and chips) since it comes pre-frozen and generally has less waste since heads and tails are normally removed.

Reference cited.

Western Pacific Regional Fishery Management Council. 1996. Pelagic fiseries of the Western Pacific Region: 1995 annual report. WPRFMC, Honolulu Hawaii.

Table 1. Unreported leakage fish moved and survey dates and times. Because it was an unusual event, the data from 1/7/95 were discarded as outliers. Confidence intervals on the averages are standard errors.

Date	Time	Unpermitted Vessels/Individuals Moving Fish	Estimated Total Pounds Moved
1/7/95	08:00-16:00	23	1100
1/10/95	16:00-24:00	2	400
1/15/95	00:00-08:00	0	0
1/20/95	08:00-16:00	1	250
1/24/95	16:00-24:00	0	0
2/1/95	08:00-16:00	0	0
2/14/95	16:00-24:00	3	300
2/23/95	00:00-08:00	0	0
3/3/95	08:00-16:00	1	200
3/8/95	16:00-24:00	1	100
3/25/95	16:00-24:00	2	350
4/3/95	00:00-08:00	0	0
4/6/95	08:00-16:00	2	450
4/15/95	16:00-24:00	0	0
Average Day			225 ±92
Average Evening			191 ±74
Average Night			0 ±0

Table 2. Number of invoices detailing pelagic fish purchases collected during 1995.

	Invoices Collected			
	Leakage Restaurants	Leakage Stores	Local Restaurants	Local Stores
Marlin	27	19	3	59
Masi Masi	43	8	67	19
Other PPMUS	6	5	1	24
Skipjack Tuna	8	1	11	83
Swordfish	45	16	0	0
Other Tuna	16	6	23	5
Wahoo	121	27	21	13
Yellowfin Tuna	44	13	175	61
TOTAL	**310**	**95**	**303**	**264**

Table 3. Quantity of pelagic fish purchased during 1995 by vendors participating in the point of purchase invoice program. Leakage is fish reported as being from the cannery or the distant water fleet.

	Pounds Sold			
	Leakage Restaurants	Leakage Stores	Local Restaurants	Local Stores
Marlin	3,081	3,174	486	7,217
Masi Masi	4,241	808	3,023	861
Other PPMUS	868	2,352	105	1,697
Skipjack Tuna	241	32	1,356	11,275
Swordfish	2,077	628	0	0
Other Tuna	1,808	1,654	3,085	423
Wahoo	23,301	7,578	1,356	536
Yellowfin Tuna	3,255	2,916	17,571	4,681
TOTAL	**38,872**	**19,142**	**26,982**	**26,690**

Table 4. Average price paid for pelagic fish as reported by local vendors through the point of purchase invoice system.

	Average Price Paid (Dollars)					
	Leakage Rest.	Leakage Stores	Total Leakage	Local Rest.	Local Stores	Total Local
Marlin	1.18	1.22	1.20	1.92	0.99	1.05
Masi Masi	1.57	1.33	1.54	2.50	1.26	2.23
Other PPMUS	1.33	0.89	1.13	0.75	1.35	1.33
Skipjack Tuna	1.50	0.75	1.42	1.71	0.67	0.78
Swordfish	2.59	2.30	2.50	----	----	-----
Tuna	1.49	1.050	1.37	1.69	1.28	1.61
Wahoo	1.02	0.86	0.98	2.11	1.22	1.77
Yellowfin	1.53	1.01	1.41	2.29	1.06	1.98

Table 5. Total value of pelagic fish purchased by vendors through the point of purchase invoice system.

	Total Revenue (Dollars)			
	Leakage Restaurants	Leakage Stores	Local Restaurants	Local Stores
Marlin	3,636	3,872	933	7,145
Masi Masi	6,658	1,075	7,558	1,085
Other PPMUS	1,154	2,093	79	2,291
Skipjack Tuna	362	24	2,319	7,554
Swordfish	5,379	1,444	0	0
Other Tuna	2,694	1,737	5,214	541
Wahoo	19,806	6,517	2,861	654
Yellowfin Tuna	4,980	2,945	40,238	4,962
TOTAL	**44,669**	**19,707**	**59,202**	**24,232**

Appendix 2

Territory of Guam

Introduction and Summary

Pelagic fishing vessels based on Guam fall into two broad categories: 1) distant-water purse seiners and longliners that fish primarily outside the EEZ and transship through Guam and 2) small primarily recreational trolling boats that are either towed to launch sites or berthed in the Marinas and fish only local waters, either within the EEZ or occasionally in the adjacent EEZ of the Northern Mariana Islands. This report covers primarily the local small-boat pelagic fishery.

During the past 16 years, the estimated number of vessels participating in the fishery has steadily increased from about 119 to approximately 436. Presently most vessels are less than 10 m (33 feet) in length and are typically owner-operated by persons who earn a living outside of fishing. However, almost everyone sells a portion of their catch at one time or another, and it is impossible to make a distinction between recreational, subsistence, or commercial fishers. A small but rapidly a growing segment of the fleet consists of marina-berthed charter vessels that are operated primarily by full-time captains and crews.

Estimated annual landings have varied widely, ranging between 175 and 429 tons. Landings consist nearly entirely of five major species: mahimahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and Pacific blue marlin (*Makaira mazara*). Minor components include rainbow runner (*Elagatis bipinnulatus*), great barracuda (*Sphyraena barracuda*), kawakawa (*Euthynnus affinis*), dogtooth tuna (*Gymnosarda unicolor*), sailfish (*Istiophorus platypterus*), and shortbill spearfish (*Tetrapterus angustirostris*). Approximately a dozen additional species are landed incidentally each year.

There are wide year to year fluctuations in the catches of mahimahi, wahoo, and tunas. However, annual landings of yellowfin tuna appear to have declined from 1982 to 1989, recovered by 1992, but have shown a drastic decline in 1993. Landings of yellowfin increased slightly during 1995. Annual landings of blue marlin increased sharply from 1980 to 1990, declined somewhat during 1993, recovered during 1994, then decreased during 1995.

Aggregate landings of non-tuna PPMUS appear to be increasing while those of the tunas show no general trend. In the early 1980s the bulk of the catch consisted of tunas, but since 1985 it has consisted of non-tuna or "other," PPMUS, with mahimahi usually the most important species. Commercial landings of all pelagics have increased steadily over the past 14 years with all of the increase in the non-tuna PPMUS segment.

Effort in terms of hours and trips has increased since 1983, while hours spent per trip has decreased. This is a reflection of the growing charter segment of the fishery which generally makes half-day rather than full-day trips.

Inflation adjusted revenues for all pelagic species, tunas and other PMUS have decreased slightly from peaks during 1983-84, while inflation adjusted revenue per trip for all pelagic species, tunas and other PMUS have sharply decreased over the past 11 years.

Annual trolling catch rates have varied widely for all species. However, there seems to have been a general increase in the catch rate of blue marlin from 1980 to 1990, followed by a general decrease since. The catch rate of yellowfin tuna peaked at 1992, but has dropped more than 50% in the last three years. The average size and size of the winning fish for yellowfin tuna caught in the Guam International Fishing Derby also decreased between 1978 and 1989, and 1979 to 1989, respectively, but has fluctuated widely since then. The period of increase in the catch rate of blue marlin was probably due to a concurrent increase in the charterboat segment which operates larger vessels more capable of targeting this species. Decreases in the catch rates and size of yellowfin tuna may be a result of either adverse impacts on their regional stocks by other (e.g., longline or purse seine) fisheries, or decreasing availability due to interception near Guam by these other fisheries.

Inflation-adjusted prices have steadily declined since 1980. The difficulty of obtaining a consistent supply of fresh fish from local fishermen has forced many marketers to turn to other sources, at least part of the time. Some hotels import higher-priced tuna from Japan to meet their demand for sashimi. There is a widespread belief among local fishermen that the flooding of local markets with inexpensive foreign-caught fish in recent years has depressed their ex-vessel prices. The Department of Commerce approximates that 5% of "rejected" fish enters the local economy.

The Guam Department of Commerce provided transshipment data for 1995. There were no domestic or foreign longliners licensed to fish within Guam's EEZ. However, the Guam Department of Commerce reported that for 1995, 448 foreign longliners made 1,948 port calls and transshipped 12,733 tons of fish through Guam. This included 7,872 tons of yellowfin tuna (62%), 3,658 tons of bigeye tuna (29%), 568 tons of blue marlin (4%), and 635 tons of albacore tuna, black marlin, striped marlin, swordfish, and others combined (5%). All these fish were allegedly caught outside of Guam's EEZ. The extent of illegal longlining activity is unknown.

Recommendations

1. The funding source for the new expansion system using the data base 4th Dimension was lost during the end of the past fiscal year. DAWR is continuing its efforts in developing the 4th Dimension database processing software through a contract with a local programming firm. Central WPacFIN is continuing to provide technical assistance to develop the new expansion algorithms which will incorporate sampling at three sites and will develop a separate stratum for monitoring the charter fishing industry.

2. Review status and ongoing usefulness of the Guam consumer price index for time-series inflation-adjustment. The Team has been concerned over the apparent continuing decline in pelagic fish prices on Guam. Although nominal (unadjusted) prices have risen, inflation-adjusted prices have continued to fall. A respected Guam economist suggested that it might be due to an outdated or incomplete market basket. This needs further investigation.

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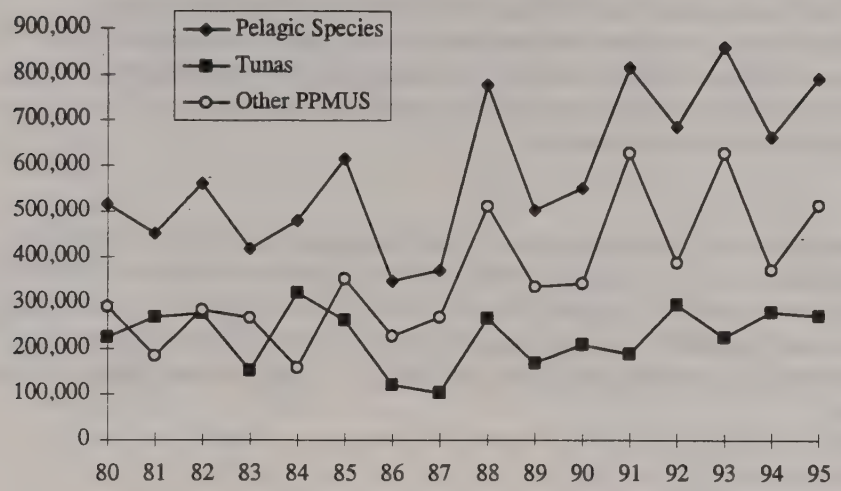
Table 1. Guam 1995 creel survey - pelagic species composition.

Species	Pounds Landed
Sharks	11,191
Mahimahi	321,014
Wahoo	78,530
Blue Marlin	101,359
Striped Marlin	0
Sailfish	1,242
Spearfish	738
Dogtooth Tuna	316
Double-lined mackerel	0
Subtotal PPMUS	**514,391**
Skipjack Tuna	192,218
Yellowfin Tuna	78,021
Bigeye Tuna	0
Kawakawa	1,266
Tunas (misc.)	0
Subtotal Tunas	**271,505**
Rainbow Runner	2,747
Barracudas	1,981
Other	552
Subtotal Misc.	**5,280**
Total Pelagics	**791,176**

Table 2. Guam 1995 annual commercial average price of pelagic species.

Species	Average Price ($/lb)
Sharks	0.55
Mahimahi	0.97
Wahoo	2.15
Marlin	.76
Sailfish	1.24
Spearfish	1.61
Dogtooth Tuna	1.69
Average Other PPMUS	**1.21**
Skipjack Tuna	1.01
Yellowfin Tuna	2.38
Average Tunas	**1.70**
Troll Fish	1.50
Rainbow Runner	1.33
Barracudas	1.46
Average All Pelagics	**5,280**
Total Pelagics	**791,176**

Figure 1. Guam annual estimated total landings: all pelagics, other PPMUS, and tunas.



Pounds Landed

Year	All Pelagics	Other PPMUS	Tunas
1980	515,631	290,703	224,928
1981	450,813	183,549	267,264
1982	560,046	284,195	275,851
1983	418,222	267,117	151,106
1984	479,134	321,143	157,991
1985	614,520	352,649	261,872
1986	347,673	227,130	120,543
1987	370,586	268,068	102,519
1988	776,336	510,551	265,785
1989	501,880	334,857	167,024
1990	549,944	341,785	208,159
1991	814,786	627,398	187,388
1992	685,513	388,634	296,833
1993	858,944	626,907	224,656
1994	663,476	372,541	279,657
1995	**791,176**	**514,391**	**271,505**
Average	**587,418**	**359,279**	**226,639**
Std Deviation	**162,666**	**143,400**	**64,981**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files. The Guam OffshoreExpansion System (GOES) and its algorithms are detailed in NMFS Admin. rep. H-83-21C. For 1992-95, the GOES was not available and expansions were calculated on a commercially available spreadsheet with Macintosh computers. Details available from DAWR on request.

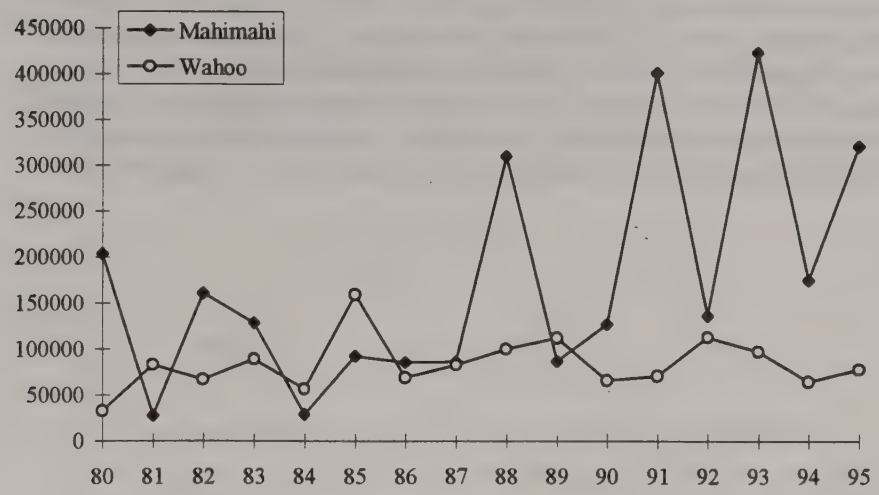
Calculation

A 362 day (363 days during leap years) expansion is run for each calendar year of survey data to produce catch and effort estimates for each fishing method surveyed. Percent species composition is calculated by weight for the sampled catch for each method to produce catch estimates for each species for the expanded period. The annual catch for all pelagic species and the PMUS separately are summed across all methods to obtain the numbers plotted above except for 1992 which includes only the trolling method.

Interpretations

Guam's pelagic fishery is growing, particularly the charter boat segment which has more than doubled during the past few years. In the early 1980's the bulk of the catch tended to consist of tunas, but since 1985 it has consisted of other (non-tuna) PMUS. Reasons for this include a trend toward decreasing size and availability of yellowfin tuna from 1983 to 1989, lack of interest in skipjack tuna, and an increasing interest in targeting blue marlin. Virtually all landings (>99%) are by the trolling method.

Figure 2. Guam annual estimated total landings: mahimahi and wahoo.



Pounds Landed

Year	Mahimahi	Wahoo
1980	203,136	32,825
1981	27,954	82,635
1982	160,200	66,416
1983	128,130	89,010
1984	28,847	56,501
1985	92,407	159,300
1986	85,393	68,830
1987	86,362	82,892
1988	310,032	99,801
1989	87,158	111,977
1990	126,968	66,107
1991	402,107	71,001
1992	136,421	112,872
1993	423,988	97,448
1994	175,183	64,595
1995	**321,014**	**78,530**
Average	**174,706**	**83,796**
Std Deviation	**124,776**	**28,930**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

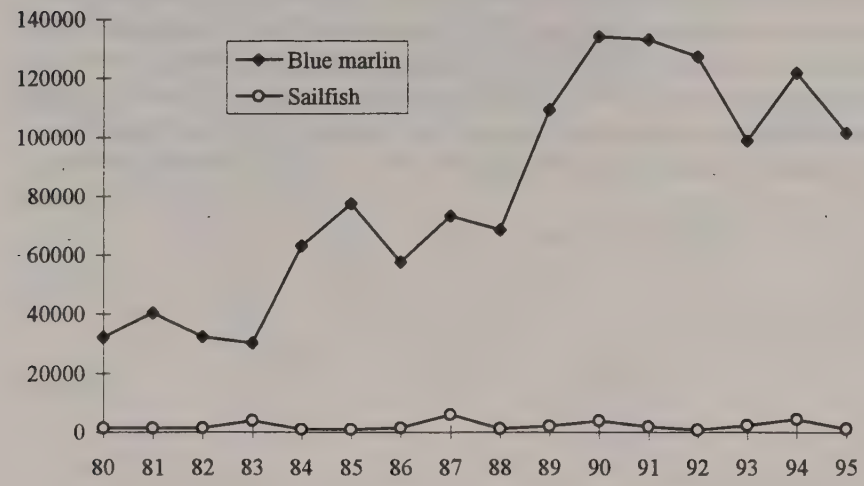
Calculation

Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Interpretations

Landings of mahimahi exceeded those of all other species during eight of the past 16 years, making it the most important species in Guam's small boat fishery. The landing of mahimahi increased significantly from 1994 to 1995, but lower than the record high of 1993. This is consistent with a long-term pattern of extreme fluctuations. Wahoo landings have fluctuated widely, but not to the extreme extent exhibited by mahimahi. Wahoo landings have declined during 1994, but then increased in 1995. Virtually all landings are by the trolling method.

Figure 3. Guam annual estimated total landings: blue marlin and sailfish.



Pounds Landed

Year	Blue Marlin	Sailfish
1980	32,192	1,411
1981	40,389	1,272
1982	32,465	1,425
1983	30,359	3,820
1984	63,057	952
1985	77,565	915
1986	57,682	1,474
1987	73,169	5,913
1988	68,511	1,145
1989	109,241	2,191
1990	136,541	3,730
1991	129,992	2,000
1992	127,356	745
1993	98,698	2,379
1994	121,844	4,482
1995	101,359	1,242
Average	**81,320**	**2,198**
Std Deviation	**37,349**	**1,510**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

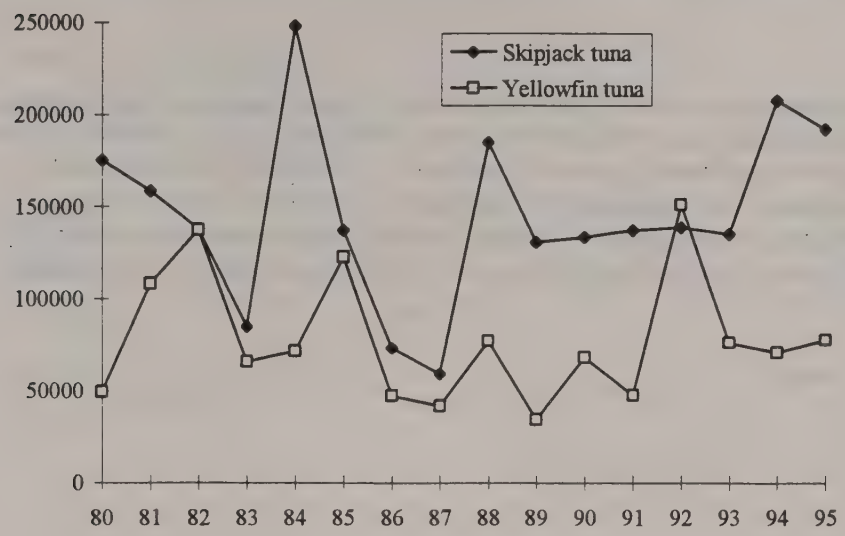
Calculation

Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Interpretations

Landings of blue marlin increased steadily between 1980 and 1990, remained high through 1992, decreased in 1993, returned to near 1990-92 levels during 1994, then decreased the past year. Growth was particularly rapid between 1988 and 1990. The rapid growth in the charter fleet is undoubtedly the reason for the historic rapid growth in landings during the 1980s up until the present. In 1990, landings of blue marlin exceeded those of all other species. Some blue marlins were tagged and released during the past three years and that number is expected to grow. Sailfish landings have remained insignificant. Virtually all landings are by the trolling method.

Figure 4. Guam annual estimated total landings: skipjack and yellowfin tunas.



Pounds Landed

Year	Skipjack Tuna	Yellowfin Tuna
1980	175,542	49,386
1981	158,493	107,828
1982	137,735	137,202
1983	85,008	65,598
1984	248,243	71,502
1985	137,097	122,707
1986	73,199	47,290
1987	59,228	41,754
1988	184,838	77,434
1989	130,682	34,404
1990	133,460	68,076
1991	137,136	47,398
1992	138,547	151,025
1993	135,163	76,285
1994	207,713	70,902
1995	**192,218**	**78,021**
Average	**145,894**	**77,926**
Std Deviation	**49,177**	**34,628**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

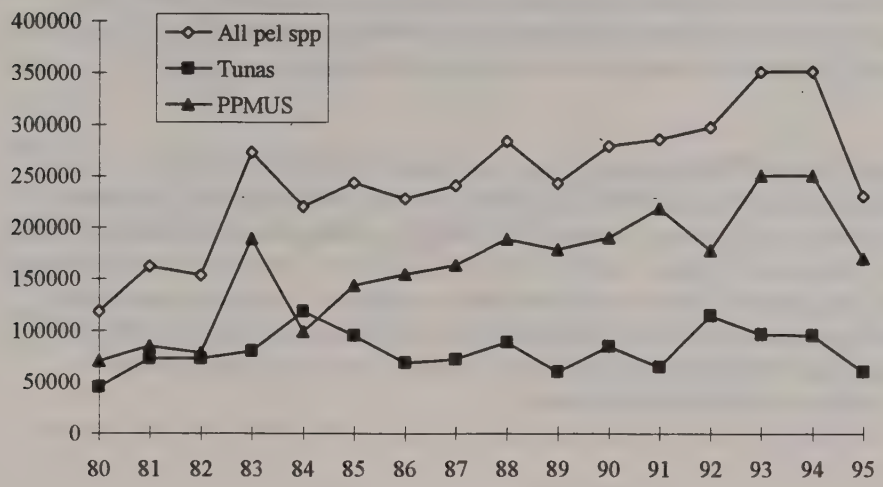
Calculation

Totals by species are summed across all fishing methods for all years except 1992-93 as described in figure 1.

Interpretations

Landings of skipjack tuna exceeded those of all other species in five of the last 15 years, and were exceeded by mahimahi in all but one of the remaining years. With the exception of 1992, landings of skipjack tuna have always exceeded those of yellowfin tuna, often by a 2:1 or better margin. Given the low demand (due to the large supply) of skipjack tuna in the local market, and the desirability of yellowfin tuna, the availability of skipjack tuna probably exceeds that of yellowfin tuna by a wider margin than this chart would indicate. Virtually all landings are by the trolling method.

Figure 5. Guam annual estimated commercial landings: all pelagics, tunas, and other PPMUS.



Pounds Landed

Year	All Pelagic Species	Tunas	Other PPMUS	
1980	118,275	45,043	70,319	
1981	162,186	72,229	84,371	
1982	153,577	72,347	77,602	
1983	273,120	79,313	189,241	
1984	220,074	118,167	98,412	
1985	243,060	94,691	143,509	
1986	227,928	68,510	154,749	
1987	240,790	71,711	163,449	
1988	283,264	87,962	188,498	
1989	242,554	59,825	178,424	
1990	279,121	84,176	190,201	
1991	285,696	64,694	218,588	
1992	296,809	114,765	178,307	
1993	351,201	96,289	250,211	
1994	351,187	95,321	250,348	
1995	230,585	60,403	170,182	
Average	**247,464**	**80,340**	**162,901**	
Std Deviation	**64,422**	**20,046**	**56,340**	

Source

The WPACFIN-sponsored commercial landings system.

Calculation

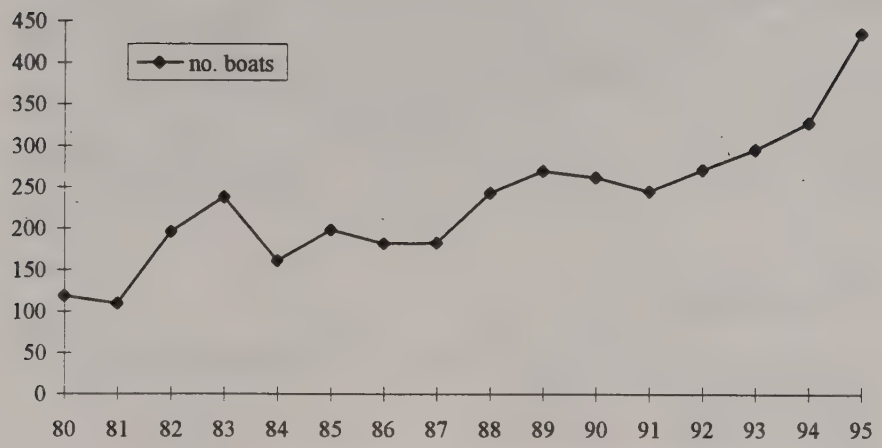
The total estimated commercial landings for each year were calculated by summing the weight fields in the commercial landings data base from the principle fish wholesalers on Guam, and then

multiplying by an estimated percent coverage expansion factor. The annual expansion factor was subjectively created based on as much information as possible depending on the year, including: an analysis of the "disposition of catch" data available from the DAWR offshore creel survey; an evaluation of the fishermen in the fishery and their entry/exit patterns; general "dock side" knowledge of the fishery and the status of the marketing conditions and structure; the overall number of records in the data base; and a certain measure of best guesses.

Interpretations

Commercial pelagic fishery landings appear to have increased steadily for the last 15 years, especially with the growth of the charterboat industry. A drop in this year's may be due to a major fish vendor going out of business during 1995, and from fishermen marketing their fish elsewhere than the Fishermen's Coop, a major receipt book vendor. Other fish vendors have also opened up in 1995 that competed with established vendors and are in the process of being brought into the commercial receipt book program. For 1996, the commercial receipt book program is attempting to identify other fish vendors to obtain a more accurate picture of commercial fish landings in this growing market.

Figure 6. Guam estimated number of trolling boats.



Year	Number of Boats
1980	119
1981	109
1982	196
1983	238
1984	161
1985	199
1986	182
1987	183
1988	243
1989	270
1990	262
1991	245
1992	271
1993	296
1994	328
1995	**436**
Average	**234**
Std Deviation	**81**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

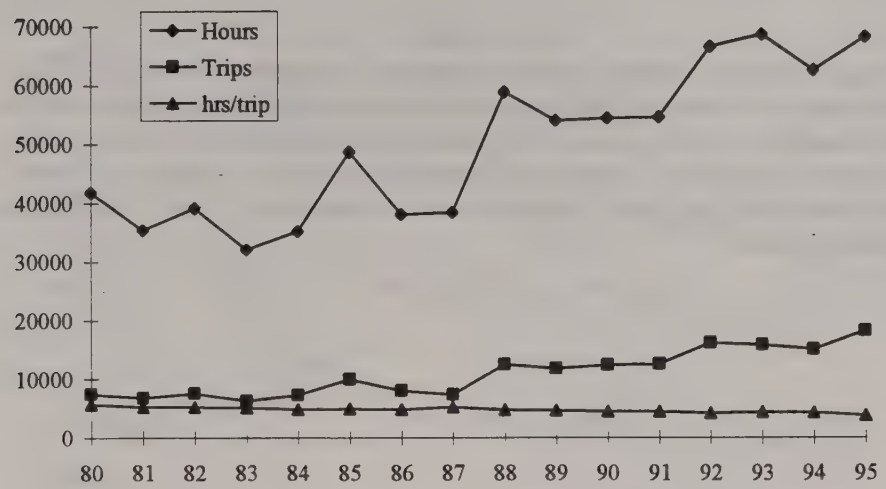
Calculation

Since only a fraction of the days of the year are actually sampled, it is not possible to know the exact number of boats participating in the fishery. Therefore, a "threshold" C/E model was run a minimum of 15 times per year. The mean estimated number of boats was selected from the sorted list of model estimates.

Interpretations

The increase in boat figures shown here may have increased since two other marinas are included in the expansion. There appears to be a general increase in the number of small boats participating in Guam's fisheries during the past 15 years.

Figure 7. Guam annual estimated pelagic species trips, hours, and hours per trip for trolling.



Year	Hours	Trips	Hours per Trip
1980	41,870	7,394	5.7
1981	35,430	6,763	5.2
1982	39,146	7,566	5.2
1983	32,085	6,287	5.1
1984	35,196	7,276	4.8
1985	48,823	9,900	4.9
1986	38,201	7,992	4.8
1987	38,475	7,342	5.2
1988	58,874	12,454	4.7
1989	54,119	11,725	4.6
1990	54,486	12,340	4.4
1991	54,686	12,523	4.4
1992	66,535	16,076	4.1
1993	68,609	15,810	4.3
1994	62,616	15,003	4.2
1995	**68,285**	**18,214**	**3.8**
Average	**49,840**	**10,917**	**5.0**
Std Deviation	**12,807**	**3,882**	**0.5**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

Calculation

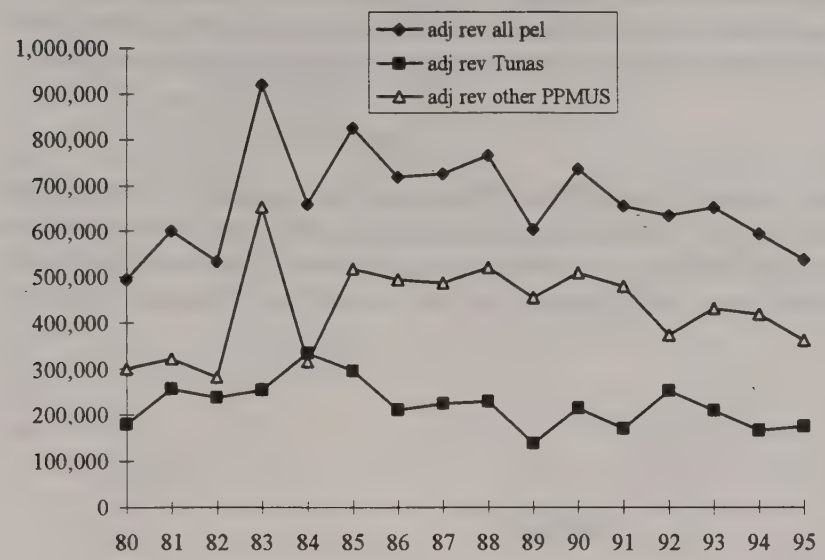
The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. These plots are of the estimated boat

hours spent fishing and number of trips for the trolling method as taken directly from creel survey expansion system printouts.

Interpretations

Guam's pelagic fishery continues to grow with the charter boat segment more than doubling since 1987. An increase in the number of hours from 1994 and a record high number of hours in 1995 was likely caused by a combination of an increase in charterboat activity and a high abundance of mahimahi during 1995. Since most charter trips and most recreational boaters are half-day rather than full-day activities, mean trip duration decreases. Effort is expected to continue its long-term growth.

Figure 8. Guam annual estimated commercial inflation-adjusted total revenues: all pelagics, tunas, and other PPMUS.



Revenues ($)

	All Pelagics		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	149,160	511,171	54,353	186,266	90,623	310,565
1981	218,384	621,303	92,914	264,342	117,052	333,014
1982	203,847	551,611	90,719	245,485	107,573	291,093
1983	364,527	953,238	100,029	261,577	258,501	675,979
1984	283,724	682,356	143,598	345,464	135,498	325,873
1985	369,651	856,111	131,953	305,604	230,855	534,661
1986	330,302	744,501	96,395	217,274	226,935	511,511
1987	347,753	750,800	107,055	231,131	233,116	503,297
1988	386,468	793,033	114,981	235,942	261,901	537,421
1989	337,586	624,534	76,865	142,201	253,932	469,774
1990	471,241	763,411	136,321	220,840	325,372	527,102
1991	462,191	678,958	119,640	175,751	337,328	495,534
1992	492,707	657,272	195,547	260,859	289,129	385,698
1993	547,835	674,385	175,360	215,869	362,728	446,518
1994	593,838	625,312	165,296	174,056	418,612	440,798
1995	**537,889**	**537,889**	**173,629**	**173,629**	**361,363**	**361,363**
Average		**665,730**		**220,780**		**431,712**
Std Deviation		**112,630**		**50,700**		**101,116**

Source

The WPACFIN-sponsored commercial landings system.

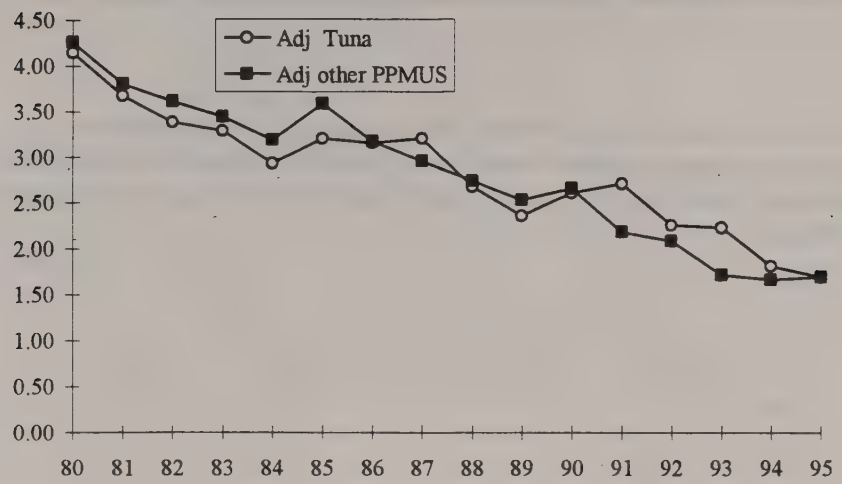
Calculation

The total estimated revenue for each year was calculated by summing the revenue fields in the commercial landings data base from the principle fish wholesalers on Guam, and then multiplying by the same percent coverage expansion factor as were the landings in figure 5. Inflation-adjusted total revenue per trip is derived from the Guam annual Consumer Price Index (CPI).

Interpretations

Revenues for all pelagic species and other PPMUS remained fairly steady from 1985 to 1990 followed by a drop since then. Revenues for tunas increased slightly from 1989 to 1992, but have fallen since then. This indicates an overall declining economic condition of the fishery when one considers that commercial landings for the same period have decreased (figure 5).

Figure 9. Guam average price of tunas and other PPMUS.



	Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1980	1.21	4.15	1.29	4.42
1981	1.29	3.68	1.39	3.96
1982	1.25	3.39	1.39	3.77
1983	1.26	3.30	1.37	3.59
1984	1.22	2.94	1.38	3.33
1985	1.39	3.22	1.61	3.74
1986	1.41	3.17	1.47	3.31
1987	1.49	3.22	1.43	3.09
1988	1.31	2.69	1.39	2.85
1989	1.28	2.37	1.42	2.63
1990	1.62	2.62	1.71	2.77
1991	1.85	2.72	1.54	2.26
1992	1.70	2.26	1.62	2.15
1993	1.82	2.24	1.45	1.78
1994	1.73	1.82	1.67	1.75
1995	**1.70**	**1.70**	**1.67**	**1.15**
Average		**2.84**		**2.84**
Std Deviation		**0.67**		**0.81**

Source

The WPACFIN-sponsored commercial landings system.

Calculation

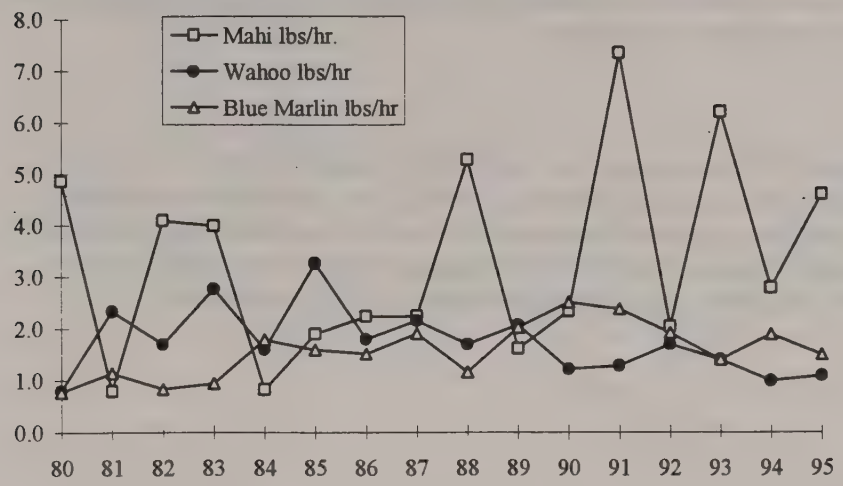
The average price of the Tunas and other PPMUS groups are calculated by dividing the total revenue for each by the sold weight. The inflation adjustment is made by using the Consumer

Price Index (CPI) for Guam and establishing the current year figure as the base from which to calculate expansion factors for all previous years (e.g., divide the current year CPI by the CPI of any given year), and then multiplying that factor by the unadjusted average price for the given year.

Interpretations

The inflation-adjusted price of Tunas and other PPMUS shows a general decline during the past 15 years. While the decline does not promote a healthy atmosphere for the commercial fishery, it does not necessarily adversely affect the charter boat industry since their success does not directly depend on the price of fish.

Figure 10. Guam trolling catch rates: mahimahi, wahoo, and blue marlin.



Pounds Per Hour Fished

Year	Mahimahi	Wahoo	Blue Marlin
1980	4.9	0.8	0.8
1981	0.8	2.3	1.1
1982	4.1	1.7	0.8
1983	4.0	2.8	0.9
1984	0.8	1.6	1.8
1985	1.9	3.3	1.6
1986	2.2	1.8	1.5
1987	2.2	2.2	1.9
1988	5.3	1.7	1.2
1989	1.6	2.1	2.0
1990	2.3	1.2	2.5
1991	7.3	1.3	2.4
1992	2.0	1.7	1.9
1993	6.2	1.4	1.4
1994	2.8	1.0	1.9
1995	**4.6**	**1.1**	**1.5**
Average	**3.3**	**1.7**	**1.6**
Std Deviation	**1.9**	**0.7**	**0.5**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

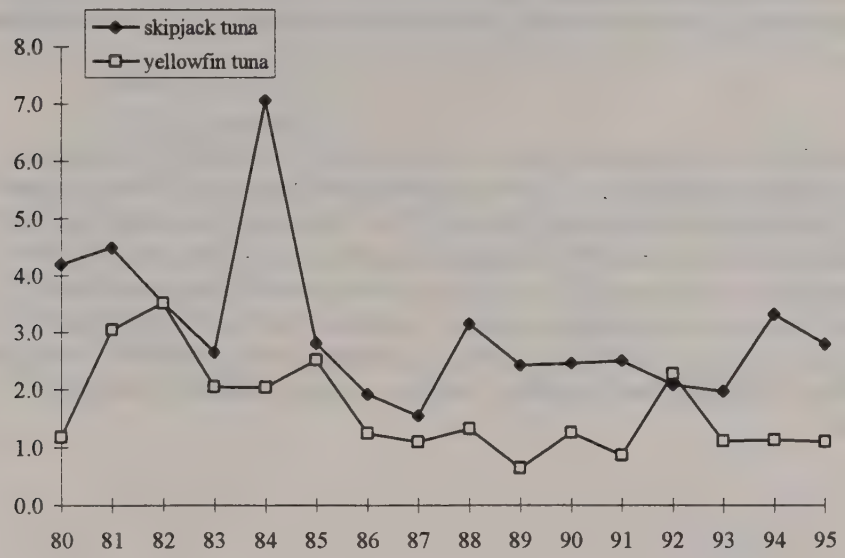
Calculation

The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method. This plot and table of catch per unit of effort (CPUE) are based on the total annual landings of mahimahi, wahoo, and blue marlin, each divided by the total number of hours spent fishing (gear in use).

Interpretations

The wide fluctuations in CPUE are probably due to the high variability in the year to year abundance and availability of the stocks. However, since it is not possible to allocate species-specific effort, effort used to target other species can also result in artificially high or low catch rates for a given species. No general trend in CPUE is apparent for wahoo or blue marlin. However, an increase in the catch rate of mahimahi was observed during the 1995.

Figure 11. Guam trolling catch rates: skipjack and yellowfin tunas.



Pounds Per Hour Fished

Year	Skipjack Tuna	Yellowfin Tuna
1980	4.2	1.2
1981	4.5	3.0
1982	3.5	3.5
1983	2.6	2.0
1984	7.1	2.0
1985	2.8	2.5
1986	1.9	1.2
1987	1.5	1.1
1988	3.1	1.3
1989	2.4	0.6
1990	2.5	1.3
1991	2.4	0.8
1992	2.1	2.3
1993	2.0	1.0
1994	3.3	1.1
1995	**2.8**	**1.1**
Average	**3.1**	**1.6**
Std Deviation	**1.3**	**0.8**

Source

The Division of Aquatic and Wildlife Resources (DAWR) offshore creel sampling program and its associated computerized data expansion system files.

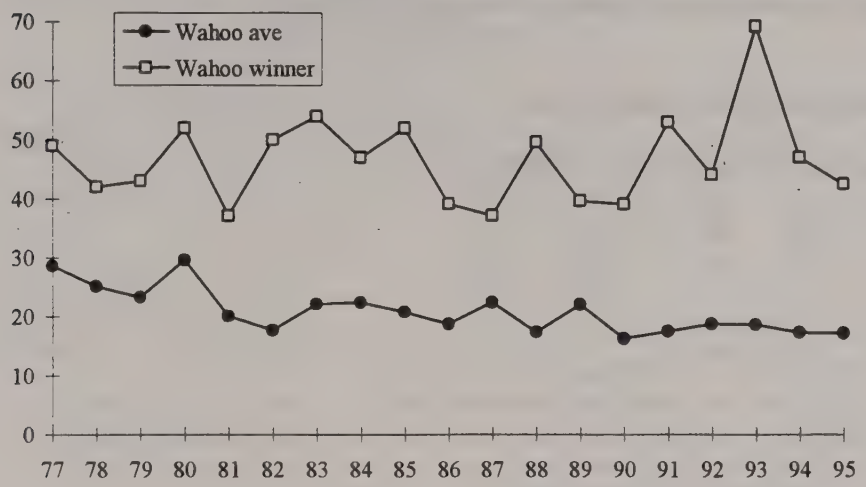
Calculation

The data expansion system is run on a calendar year's worth of survey data to produce catch and effort estimates for each fishing method surveyed. This plot and table were calculated in the same way as figure 10.

Interpretations

The wide fluctuations in CPUE for tunas are probably due to the high variability in the year to year abundance and availability of the stocks. However, there does seem to have been a general decline in the CPUE of yellowfin tuna between 1982 and 1989. This could have been a result of either declining abundance of the stocks, or decreasing availability due to interception by the purse-seine or longline fleets in the Guam EEZ, or both. It is also possible that a large annual effort directed at one or more other trolling species could result in an artificial decline in the CPUE of the species shown here. If the decline was due to interception by purse-seine or longline fleets, restriction of their operations from the waters near Guam and its offshore banks could alleviate the problem.

Figure 12. Guam International Fishing Derby - average size and size of winning fish: wahoo.



Year	Number Caught	Average Size (lb.)	Winning Fish (lb.)
1977	7	28.7	49
1978	9	25.1	42
1979	11	23.2	43
1980	12	29.5	52
1981	60	20.0	37
1982	33	17.6	50
1983	36	22.1	54
1984	46	22.3	47
1985	98	20.7	52
1986	16	18.7	39
1987	31	22.3	37
1988	72	17.3	49.5
1989	59	22.0	39.5
1990	34	16.2	38.9
1991	40	17.4	52.9
1992*	38	18.7	44.0
1993	19	18.6	69.2
1994	112	17.3	47.0
1995	**81**	**17.2**	**42.5**
Average	**43**	**20.8**	**46.6**
Std Deviation	**31**	**3.8**	**7.8**

Source
The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation

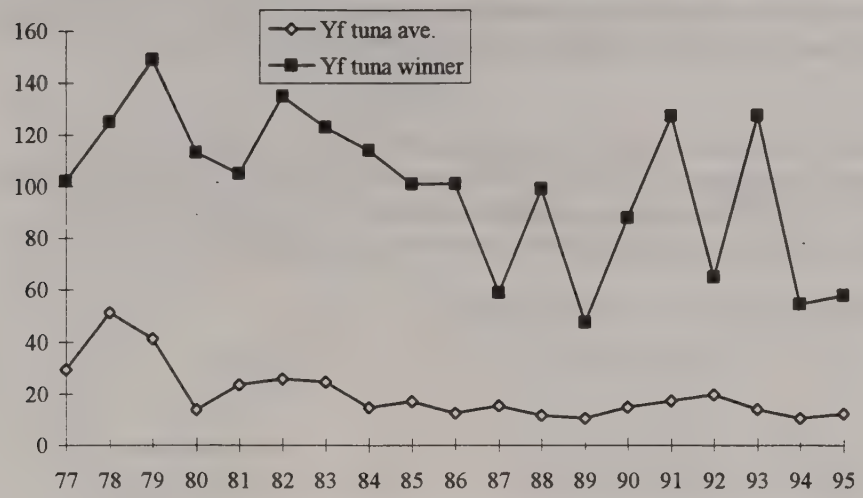
The Guam International Fishing Derby (GIFD) is an annual three day event that occurs in July or August. Most of the wahoo caught are measured or weighed by derby officials. The figures here include some fishes whose weights are based on an average or estimate.

Interpretations

No general trend is apparent over the last 17 years.

*Third day of derby canceled; results based on two days of fishing.

Figure 13. Guam International Fishing Derby - average size and size of winning fish: yellowfin tuna.



Year	Number Caught	Average Size (lb.)	Winning Fish (lb.)
1977	18	29.3	102
1978	11	51.2	125
1979	34	41.2	149
1980	50	13.7	113
1981	109	23.4	105
1982	205	25.6	135
1983	100	24.5	123
1984	59	14.6	114
1985	137	17.0	101
1986	71	12.6	101
1987	116	15.3	59
1988	161	11.6	99
1989	81	10.5	47.5
1990	81	14.9	88
1991	102	17.4	127.4
1992*	99	19.8	65.0
1993	103	14.1	127.6
1994	56	10.5	54.9
1995	**174**	**12.2**	**58.0**
Average	**93**	**20.0**	**99.7**
Std Deviation	**51**	**10.8**	**30.1**

Source
The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation

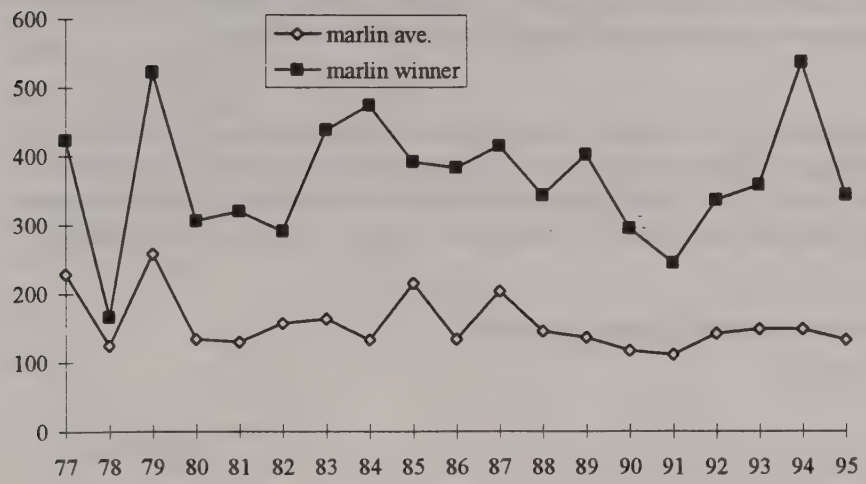
The Guam International Fishing Derby (GIFD) is an annual three day event that occurs in July or August. Most of the yellowfin tuna caught are measured or weighed by derby officials. The figures here include some fishes whose weights are based on an average or estimate.

Interpretations

The size of the winning fish has fluctuated widely since 1986. This may indicate a lowered abundance of relatively large fishes since then. There seems to have been a slight recovery in the average size from 1989 to 1992 following a general decline during the previous 10 years. However the average size has declined since then, recovering only slightly this year.

*Third day of derby canceled; results based on two days of fishing.

Figure 14. Guam International Fishing Derby - average size and size of winning fish: blue marlin.



Year	Number Caught	Average Size Winning Fish (lb.)	(lb.)
1977	9 228.4	423	
1978	9 125.2	166	
1979	6 258.4	523	
1980	12	133.6	306
1981	34	130.1	320
1982	12	156.6	291
1983	13	163.6	439
1984	47	133.2	475
1985	17	215.2	392
1986	47	134.1	383
1987	43	203.9	415
1988	58	145.7	342.5
1989	86	136.7	402
1990	64	117.9	295
1991	61	112.0	245
1992*	42	142.5	336.0
1993	27	148.4	358.5
1994	45	148.6	538.5
1995	**68**	**132.9**	**343.5**
Average	**37**	**156.2**	**368.1**
Std Deviation	**24**	**40.4**	**92.0**

Source
The Division of Aquatic and Wildlife Resources (DAWR) annual reports.

Calculation

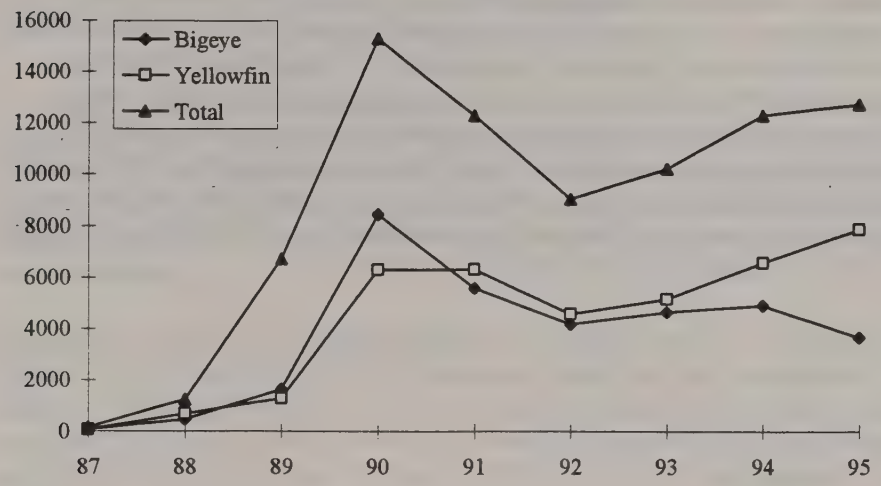
The Guam International Fishing Derby (GIFD) is an annual three day event that occurs in July or August. Most of the billfish caught are measured or weighed by derby officials. The figures here may include a few fishes whose weights are based on an average or estimate.

Interpretations

No general trend is apparent over the last 17 years. However there seems to have been a slight decline in the size of the winning fish and average size between 1987 and 1991 followed by a recovery during 1992 and 1993. The size of the winning fish this year was substantially smaller than 1994, but within the long-term average of blue marlin caught at the Guam International Fishing Derby.

*Third day of derby canceled; results based on two days of fishing.

Figure 15. Annual Guam longline landings from foreign longliners fishing primarily outside the Guam EEZ.



Year	Total (tons)	Bigeye tuna (tons)	Yellowfin tuna (tons)
1987	144	60	72
1988	1,236	462	682
1989	6,691	1,615	1,274
1990	15,278	8,433	6,283
1991	12,264	5,549	6,279
1992	9,017	4,150	4,537
1993	10,207	4,630	5,126
1994	12,283	4,896	6,553
1995	**12,733**	**3,658**	**7,872**
Average	**8,873**	**3,717**	**4,298**
Std Deviation	**5,246**	**2,655**	**2,884**

Source

The Guam Department of Commerce.

Calculation

Pre-1990 data was extracted directly from transshipment agents' files. Beginning in 1990, a mandatory data submission program was implemented.

Interpretation

Annual landings of the primarily foreign longline fishing fleet which transships its catch out of Guam have ranged up to 15,278 tons since the fishery began in the late 1980's. The majority of have been made by Taiwanese vessels (85%) followed by Japanese vessels (14%). Less than 1% were attributed to vessels from two other nations, Honduras and Indonesia. Overall landings for

1995 comprise of 29% bigeye tuna, 62% yellowfin tuna, 6% various marlin species, and 3% of all other species combined.

Of the total fish entering Guam through longliners, 27% were classified as "rejected" fish. According to the Department of Commerce, this fish is either kept on Guam for storage for later shipment to canneries, sold on Guam, given out, or destroyed. The Department of Commerce estimates that approximately 5% of the "rejected" fish enters the local fish market on Guam. Current regulations allow for this fish to enter the local market, but only as value-added or processed fish. The Department of Commerce is aware of the fish leakage into the local market. However, the agency responsible for regulating that this "rejected" longline fish entering the local market is value-added or processed fish and for developing Standard Operating Procedures for this new market is the Department of Customs and Quarantine.

Appendix 3

Hawaii

This report contains up-to-date information on Hawaii's commercial pelagic fishery. Data on the recreational fishery are not available. Commercial fisheries data are compiled from two sources: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports, and National Marine Fisheries Service (NMFS) Honolulu Laboratory longline logbooks and marketing monitoring samples. The HDAR summaries were produced from the State's mandatory commercial catch reporting system.

The module was prepared using preliminary 1995 NMFS and HDAR commercial fishery data for Hawaii. NMFS longline data for 1993-94 were updated and can be considered "final", but further updates of 1995 longline figures can be expected later in the year. HDAR commercial catch reports for 1995, which comprise the troll, handline, pole-and-line, and other gears data, are approximately 90% complete. To make HDAR data for 1995 comparable in coverage to the complete 1994 figures (which have been updated in this report), HDAR pounds caught, pounds sold, and revenue figures were extrapolated by a factor of 1.043. "Final" NMFS and HDAR figures for 1995 will appear in the annual report for 1996.

Data for previous years (including a time-series back to 1948 but primarily data from 1987) were updated extensively to update and correct previous figures and estimates and to use consistent time-series data for comparison purposes. In some cases there may be inconsistencies between alternative data sets. Where possible, these will be rectified. However in some cases where estimation procedures were employed (e.g., the 1979-1986 longline time-series), differences will reflect different methods of dealing with missing information.

Small differences between species tables and gear tables may also exist due to rounding and differences in defining relevant gear types and species groupings.

The module was prepared by Sam Pooley, NMFS, using an integrated WordPerfect 6.0 template including Tables and Figures. Information on HDAR Commercial Marine Licenses was provided by Walter Ikehara and Reginald Kokubun, HDAR. The WordPerfect template was prepared by Jill Fox, temporary editorial assistant from the Council, based on the WP6 text files created by Walter Ikehara and Bob Skillman for last year's module. The template approach (using WPDraw) is a tremendous advantage over previous methods because it allows for changes in graphs without requiring re-generation of the graphics in a separate software package and importing the graph "pictures" into the WP text. However the table and graph data used in WP6 must be entered separately (in some case "cut & paste" is possible). The final form of this module was prepared by Council clerical staff.

HDAR commercial marine license information:

Every fisherman, including captain and crew, who sells any marine species is required by the State to have a Commercial Marine License (CML) and, unless specifically exempted[1], is required to submit a catch report monthly to HDAR.

A total of 3,481 fishermen were licensed in calendar year 1995, of which 2,555 were required to report. As of June 1996, HDAR had received 27,335 monthly reports (83% of the 32,819 monthly reports expected based on the number of license holders and the number of months in 1995 in which they held their licenses).

HDAR asks fishermen to identify their primary fishing gear or method on the Commercial Marine License at time of licensing. This does not preclude fishermen from using other gears or methods, but it indicates what they consider to be their primary fishing method. In 1995, there were 1,504 trollers (-0.7% from 1994), 589 were longliners (-1.0%), 151 (+0.7%) were tuna handliners *(ika shibi* or *palu ahi*), and 53 (-14.5%) were baitboat fishermen. The total number of pelagic fishermen in 1995 was 2,297 (-0.7%). Of these licensed fishermen, 1,640 (-1.0%) were required to file reports (1,387 trollers (-7.0%), 116 longliners (+0.9%); 130 handliners (+0.8%); and 7 baitboat fishermen (+16.7%).

[1] Only one person per vessel or fishing trip is required to submit a catch report. This person is usually, but not always, the captain. (The captain may or may not be the vessel owner.) Crew members are generally not required to submit catch reports.

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Table 1. Hawaii domestic commercial landings, revenue and prices[2], 1994-95.

Species	1994 Pounds Landed (x 1,000)	1994 Ex-vessel Revenue (x $1,000)	1994 Ave. Price ($/lb)	1995 Pounds Landed (x 1,000)	1995 Ex-vessel Revenue (x $1,000)	1995 Ave. Price ($/lb)
Swordfish	7,000	16,300	2.33	5,900	13,100	2.22
Blue marlin	1,500	1,500	1.00	1,900	1,500	0.79
Striped marlin	800	1,300	1.63	1,300	1,300	1.00
Other billfish	300	300	1.00	500	500	1.00
Mahimahi	1,000	1,900	1.90	1,000	1,700	1.70
Wahoo	400	1,000	2.50	600	1,100	1.83
Moonfish	500	600	1.20	600	700	1.17
Sharks[3]	1,700	100	0.06	3,500	400	0.11
Other pelagics	30	40	1.33	100	100	1.00
Non-Tuna PMUS Subtotal	**13,230**	**23,040**	**1.74**	**15,400**	**20,400**	**1.32**
Albacore	1,300	1,600	1.23	3,100	3,000	0.97
Bigeye tuna	4,300	15,200	3.53	4,600	15,500	3.37
Bluefin tuna	30	400	13.33	100	700	
Skipjack tuna	1,500	2,300	1.53	1,900	2,100	1.11
Yellowfin tuna	4,100	10,000	2.44	4,600	10,300	2.24
Other tunas	100	200	2.00	10	10	1.00
Tuna PMUS Subtotal	**11,330**	**29,700**	**2.62**	**14,310**	**31,610**	**2.21**
TOTAL	**24,560**	**52,740**	**2.15**	**29,710**	**52,010**	**1.75**

Data

Data are combined from NMFS longline estimates and HDAR commercial catch reports for other pelagic gears. (See subsequent tables for details.) Due to rounding, totals between tables may differ.

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[2] Average price is calculated for this table as (*Ex vessel revenue / Pounds Landed*), rather than Pounds Sold.

[3] Shark "landings" represent estimated whole weight, often of sharks whose fins were the only part actually landed.

Interpretation

Hawaii pelagic landings for 1995 increased slightly from 1994, although ex-vessel revenue declined with lower average prices. (Prices are discussed later in this module.) The increase in landings was from the longline fishery (see Table 2.)

Data Source: Imported from N8795P.cal (6/4/96)

Table 2. Hawaii commercial pelagic landings and revenue by gear, 1994-95.

Gear	Pounds Landed (x 1,000)	Pounds Sold (x 1,000)	Ex-vessel Revenue (x $1,000)	Average Price ($/lb)
		1994		
Baitboat	1,160	1,150	1,835	1.60
Handline[4]	2,500	2,470	5,080	2.06
Longline[5]	18,100	18,100	40,960	2.26
Trolling	2,915	2,520	5,130	2.04
TOTAL	**24,675**	**24,240**	**53,005**	**2.19**
		1995		
Baitboat	1,340	1,340	1,610	1.20
Handline	2,140	2,110	3,580	1.70
Longline	22,550	22,550	42,200	1.87
Trolling	2,770	2,330	4,200	1.80
Other[6]	860	720	580	0.81
TOTAL	**29,660**	**29,050**	**52,170**	**1.80**

Data

Data are from NMFS longline estimates and HDAR commercial catch reports for other pelagic gears. HDAR commercial catch reports were categorized into Baitboat (pole-and-line skipjack tuna); pelagic handline for pelagics; pelagic trolling; and other pelagic landings. (See subsequent table for Longline details.) Due to rounding, totals between tables may differ.

Interpretation

Baitboats (pole-and-line skipjack (*aku*)) continued their low level of landings (compared to the period before the mid-1980s). Pelagic handline and trolling landings decreased slightly but handline and trolling revenues decreased substantially (-24%) due in part to the decline in landings but more due to the substantial decline in aggregate price (-18% for handline pelagics and -12% for trolling). Longline aggregate price declined by 13%. Aggregate prices combine the effects of changing species composition as well as species-specific price changes. (See also Figures for more information on landings by species.) Pelagic landings reported by other gears are negligible (less than 2,000 pounds). "Other" landings are predominately distant-water albacore landings in Honolulu.

Data Source: Data imported from GAS9n.dbf (6/4/96) and LL95b.cal (3/1/96) in N8795A.cal (7/2/96).

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4 Pelagic handline only.

5 Various non-PMUS species recorded in 1994 are included in this figure.

6 "Other" not included in 1994 since total pelagic landings by Other gears was less than 2,000 pounds. However "Other" landings are included in species totals and generally under the "Trolling-Handline-Other" category.

Table 3a. Hawaii longline landings, catch per unit effort, and revenue, 1994-95.[7]

Species	1994 CPUE (No. caught per 1,000 hooks)	1994 Landings (x 1,000 lb)	1994 Revenue (x $1,000)	1995 CPUE (No. caught per 1,000 hooks)	1995 Landings (x 1,000 lb)	1995 Revenue (x $1,000)
Blue marlin	0.39	800	1,020	0.65	1,260	1,100
Striped marlin	0.94	720	1,220	1.65	1,200	1,210
Swordfish	3.61	7000	16240	2.77	5,840	13,080
Other billfish		220	290		450	420
Mahimahi	2.75	380	540	4.47	550	750
Moonfish	0.42	520	570	0.47	630	690
Ono (wahoo)	0.21	90	240	0.48	190	300
Other Pelagics		20	30		100	140
Sharks	9.56	1,710	110	5.23	3,470	440
Non-Tuna PMUS Subtotal		**11,460**	**20,260**		**13,690**	**18,130**
Albacore	2.59	1,100	1,360	3.40	1,950	2090
Bigeye tuna	4.01	3,940	14620	4.42	4,520	15,310
Bluefin	0.01	30	440	0.02	50	730
Skipjack tuna	0.37	80	60	1.00	220	160
Yellowfin tuna	1.13	1,340	3,910	1.75	2,100	5,720
Other tuna	0.20	40	210			
Tuna PMUS Subtotal		**6,530**	**20,600**		**8,840**	**24,010**
Misc. non-PMUS		110	100		20	20
TOTAL	**29.67**	**18,100**	**40,960**	**36.12**	**22,550**	**42,160**
Number of hooks set x 1,000	**11,996**	na	na	**13,325**	na	na

[7] Data from all trip types combined. Changes in species composition, including changes in CPUE, should be qualified by trip type (see following table).

Data

Data are from NMFS Honolulu Laboratory compilations based on Federal logbooks filed by domestic longliners operating out of Hawaii. **CPUE** is the number of fish caught per 1,000 longline hooks. Landings are estimates compiled by multiplying NMFS logbook figures for number kept per species by average weight per species from NMFS market monitoring in Honolulu. Data for 1995 are from preliminary average weights. Revenue is based on whole weight prices and use Hawaii Division of Aquatic Resources average price per pound (ex vessel), except for swordfish and shark which are adjusted to whole-weight prices.

Interpretation

Changes in species composition and CPUE should be qualified by reference to changes in trip type (see following table). Aggregate CPUE rose for most species except swordfish. Swordfish CPUE declined largely because a smaller amount of longline fishing effort **targeted** swordfish in 1995, with effort shifting more towards tunas. CPUE figures are considered more reliable indicators of underlying fish stocks when targeting is taken into consideration *(trip type)*. The increase in longline landings and revenues derives from increased landings of most species (except swordfish). Landings of blue and striped marlin increased, as did landings of albacore, bigeye, and yellowfin tuna. Landings of sharks also increased as use of shark fins increased (shark landings figures represent the *whole weight* estimate based on the number of sharks finned or kept whole).

Changes in landings are further explained in the subsequent section which details landings by gear type and species.

More detailed information on longline catch and effort statistics will be included in the NMFS annual report on the fishery being compiled by Russell Ito, Honolulu Laboratory.

Source: Data loaded from LL95b.cal (6/4/96)

Table 3b. Hawaii longline catch per unit effort by trip type, 1994-95.[8]

	1994				1995			
Species	**All Trip Types**	**Swordfish**	**Mixed**	**Tuna**	**All Trip Types**	**Swordfish**	**Mixed**	**Tuna**
Blue marlin	0.39	0.21	1.30	0.29	0.65	0.75	1.21	0.51
Striped marlin	0.94	0.45	0.71	1.24	1.65	0.80	1.49	1.83
Swordfish	3.61	10.34	4.12	0.16	2.77	14.98	6.85	0.23
Mahimahi	2.75	2.62	6.56	2.03	4.47	7.90	10.80	2.51
Moonfish	0.42	0.01	0.02	0.71	0.47	0.02	0.08	0.63
Ono (wahoo)	0.21	0.04	0.06	0.32	0.48	0.19	0.23	0.61
Sharks	9.56	23.43	11.64	2.22	5.23	32.13	13.33	2.95
Albacore	2.59	4 48	0.80	2.03	3.40	6.42	2.13	3.33
Bigeye tuna	4.01	1.01	3.92	5.52	4.42	2 74	4.88	4.61
Yellowfin tuna	1.13	0.41	2.69	1.16	2.74	1.31	3.14	1.48
Number of hooks set x 1,000	**11,996**	**3,506**	**1,450**	**7,039**	**13,325**	**1,229**	**2,367**	**9,727**

[8] Trip type refers to the primary species target for each trip. (See *Data* description below).

Data

Data are from NMFS Honolulu Laboratory compilations based on Federal logbooks filed by domestic longliners operating out of Hawaii. ***CPUE*** is the number of fish caught per 1,000 longline hooks. *Trip Type* refers to the identification of the primary target species for a particular trip, either as indicated by the vessel captain to NMFS logbook collection staff or designated by NMFS in the absence of a captain's designation.

Interpretation

This table shows the shift in longline fishing effort from swordfish to tuna as target species. The number of longline hooks directed at swordfish fell by over 50% in 1995, continuing the decline in 1994. Mixed trip and tuna trip hooks increased substantially, more than offsetting the decline in swordfish hooks. Differentiating CPUE by trip type shows dramatic differences in CPUE for individual species, and with a shift in trip types between years, a substantial difference in aggregate (*All Trip Types)* CPUE. Swordfish CPUE on swordfish trip types increased by 40% from 1994 to 1995. However this increase may reflect a smaller number of more specialized swordfish longliners and a smaller number of longliners which occasionally target swordfish. Increased relative abundance of blue marlin and striped marlin in 1995 is shown by higher CPUEs for all trip types. The same is true for mahimahi and ono (wahoo). Shark CPUEs varied by trip type. Albacore was relatively more abundant across all trip types, while the remaining tunas were mixed. More detailed information on longline CPUE statistics will be included in the NMFS annual report on the fishery being compiled by Russell Ito, Honolulu Laboratory.

Source: Data loaded from LL95b.cal (6/4/96)

Table 3c. Hawaii longline catch (number of fish caught) by area fished, 1994-95.

Species	1994			1995		
	All Locations	Main Hawaiian Islands EEZ	Outside of U.S. EEZs	All Locations	Main Hawaiian Islands EEZ	Outside of U.S. EEZs
Blue marlin	4,677	3,344	742	8,873	4,207	3,189
Striped marlin	11,292	6,494	1,946	22,715	12,580	4,937
Swordfish	43,345	6,494	30,689	37,622	5,273	23,928
Mahimahi	33,017	17,660	12,283	60,748	30,759	23,899
Moonfish	5,090	3,626	733	6,416	4,076	1,396
Ono (wahoo)	2,513	1,332	877	6,764	2,787	2,868
Sharks	114,656	14,455	71,150	101,773	22,683	58,267
Albacore	31,129	10,833	14,553	46,100	18,363	22,344
Bigeye tuna	48,102	27,022	9,227	60,680	32,253	18,944
Yellowfin tuna	13,516	6,815	3,037	23,789	13,078	6,502
Number of hooks set x 1,000	**11,996**	**5,451**	**4,128**	**13,325**	**7,067**	**4,213**

Data

Catch is *Number Caught* based on Federal logbooks filed by domestic longliners operating out of Hawaii. The Main Hawaiian Islands (MHI) EEZ (Exclusive Economic Zone) represents all longline catch within 200 miles of the eight main islands of Hawaii, except for the overlap with the Northwestern Hawaiian Islands (NWHI). Catch in other U.S. EEZ areas is not tabled but includes the NWHI 200-mile zone and the EEZ for U.S. possessions in the central and western Pacific (e.g., Wake Island).

Interpretation

Fishing effort increased within the MHI EEZ and remained steady outside the U.S. EEZs. The increased number of hooks set in the longline fishery represents the more hooks set in tuna fishing compared to swordfish fishing. The increase in blue and striped marlin catch also represents this change in targetting practices.

More detailed information on longline catch and effort statistics will be included in the NMFS annual report on the fishery being compiled by Russell Ito, Honolulu Laboratory.

Source: Data loaded from LL95b.cal (6/4/96)

Table 4a. Average estimated round weight (in pounds) of fish by gear type, 1987-95.

Year	Non-Tuna PMUS					Tunas			
	Swordfish	Blue marlin	Striped marlin	Mahimahi	Wahoo (ono)	Bigeye	Yellowfin	Albacore	Skipjack
					Longline				
1987	129.3	161.4	66.2	21.1	33.3	76.3	81.9	62.3	--
1988	119.2	157.3	56.9	20.0	31.9	83.2	102.5	59.7	--
1989	131.1	164.7	61.5	23.0	34.6	77.0	103.7	62.0	--
1990	147.6	198.4	61.5	18.7	36.0	79.8	121.9	61.2	--
1991	152.6	174.1	56.2	14.8	31.6	86.3	116.6	51.3	19.7
1992	178.1	167.1	69.7	10.9	34.7	77.0	97.3	46.7	16.4
1993	171 6	154.0	65.0	12.8	32.4	89.3	95.0	46.2	17.0
1994	162.7	170.6	63.5	11.8	34.2	80.9	97.4	41.3	17.6
1995	**167.0**	**157.0**	**58.0**	**10.0**	**30.0**	**79.0**	**93.0**	**51.0**	**17.0**
Average	151.0	167.2	62.1	15.9	33.2	81.0	101.0	53.5	17.5
Standard Deviation	20.7	13.5	4.5	4.9	1.9	4.5	12.2	8.0	1.3

Data

Longline data are from NMFS Honolulu Laboratory market monitoring. Where fish are presented in less than whole form, conversion factors are applied to convert to whole weight. This is not frequent for longline landings (except for swordfish), but was frequent for troll and handline landings.

Interpretation

No substantial changes in average weights of longline caught pelagic species are identified by this table. More detailed analysis of weight composition is found in NMFS annual longline monitoring reports.

Table 4b. Average estimated round weight (in pounds) of fish for troll-handline-other gears, 1987-95.

	Non-Tuna PMUS					Tunas			
Year	Swordfish	Blue marlin	Striped marlin	Mahimahi	Ono (wahoo)	Bigeye	Yellowfin	Albacore	Skipjack
	Troll and Handline								
1987	126	215	66	21	24	14	32	33	7
1987	124	181	64	18	25	34	32	64	7
1988	107	188	68	21	25	24	44	55	11
1989	97	248	76	20	25	25	41	58	7
1990	122	197	63	15	23	29	34	53	9
1992	75	215	70	14	26	28	27	53	6
1993	139	182	67	14	24	22	44	55	7
1994	95	233	67	14	27	30	37	53	9
1995	**110**	**204**	**61**	**16**	**24**	**15**	**30**	**22**	**7**
Average	111	207	67	17	25	25	36	50	8
Standard Deviation	19.6	23.1	4.4	3.0	1.2	6.7	6.2	13.3	1.6

Data

Troll-handline-other gear data are from HDAR commercial catch reports. Correction cannot be made for fish recorded in processed form. Average weight is calculated as Pounds Caught *divided by* Number Caught. *Other* gear represents all other gears except troll, handline, longline, and baitboat. In this table it primarily relates to distant-water albacore trolling.

Interpretation

All species caught by trolling, handline, or other gears are within their recent ranges, except for albacore. Albacore are much lower in size in 1995 due to substantial landings in Honolulu by distant-water albacore trollers, which tend to catch smaller fish than the handivers.

Table 5a. Hawaii longline vessel activity (trips), 1991-1995.

Year	Total Trips	Tuna Trips	Mixed Trips	Swordfish Trips
1991	1,670	556	823	291
1992	1,265	458	530	277
1993	1,192	542	319	331
1994	1,107	569	228	310
1995	**1,125**	**682**	**307**	**136**
Average	1,272	561	441	269
Standard Deviation	207	72	215	69

Data

Data compiled by the NMFS Honolulu Laboratory's Fishery Monitoring & Economics Program from NMFS Federal logbooks. Type of trip is usually determined by interview with the vessel captain or occasionally by FMEP staff interpretation of salient characters from fishing vessel gear design, fishing locations, and catch composition. Detailed longline effort data is only available beginning in the 1991 calendar year when Federal logbooks went into effect.

Interpretation

This table shows the dramatic shift in longline fishing target away from swordfish toward tuna (primarily bigeye tuna) in 1995. As a result of this shift, interpretation of longline catch statistics should reflect the changing nature of longline fishing effort.

Source: LLCS.prg by F. Dowdell (3/18/96)

Table 5b. Hawaii longline vessel activity (miles to first set and days fishing), 1991-1995.

	Tuna Trips		Mixed Trips		Swordfish Trips	
	Ave. miles to first set	Ave. days fishing	Ave. miles to first set	Ave. days fishing	Ave. miles to first set	Ave. days fishing
1991	240	9	276	7	585	14
1992	260	10	404	10	733	18
1993	222	10	520	12	811	19
1994	275	10	337	10	796	19
1995	**273**	**12**	**398**	**12**	**884**	**20**
Average	254	10.2	387	10.2	762	18
Standard Deviation	20	0.98	81	1.83	101	2.10

Data

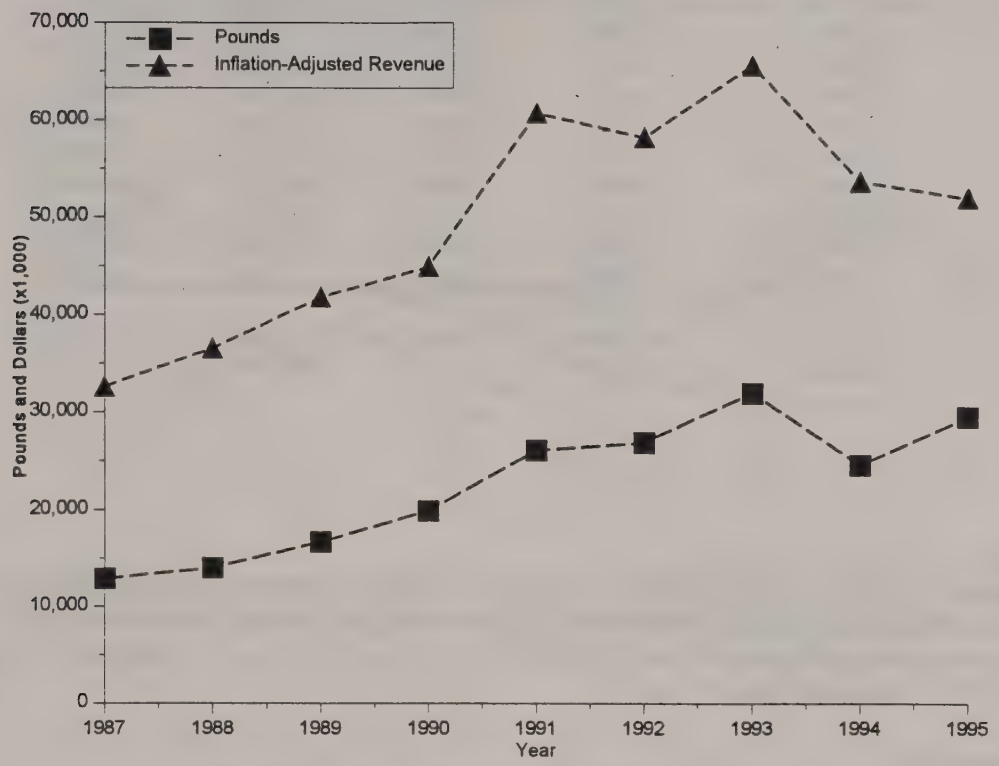
Data compiled by the NMFS Honolulu Laboratory's Fishery Monitoring & Economics Program from NMFS Federal logbooks. Determination of the type of trip is explained in the previous table. Miles to first set is determined as the distance from Honolulu to the first set as recorded on the logbook. Average days fishing is determined by the number of days on which sets and hauls occurred on an individual trip.

Interpretation

This table shows no dramatic changes for tuna and mixed species trips, but an increase in the range of the vessels which continue to target swordfish.

Source: LLCS.prg by F. Dowdell (3/18/96)

Figure 1. Hawaii commercial pelagic landing and revenue (all gears and species).



Hawaii commercial pelagic landings and revenue (all gears and species).

Year	Pounds (x 1,000)	Nominal Revenue (x$1,000)	Adjusted Revenue (x $1,000)	Honolulu Consumer Price Index
1987	12,900	22,600	32,603	115.90
1988	14,000	26,800	36,490	123
1989	16,700	32,400	41,768	129.70
1990	19,900	37,300	44,900	138.90
1991	26,100	54,100	60,749	148.90
1992	26,900	54,300	58,236	155.90
1993	32,000	63,100	65,652	160.70
1994	24,600	52,900	53,697	164.72
1995	29,600	52,100	52,100	167.20
Mean	22,500	44,000	49,600	144.97
Standard Deviation	6,500	13,500	10,700	17.87

Data

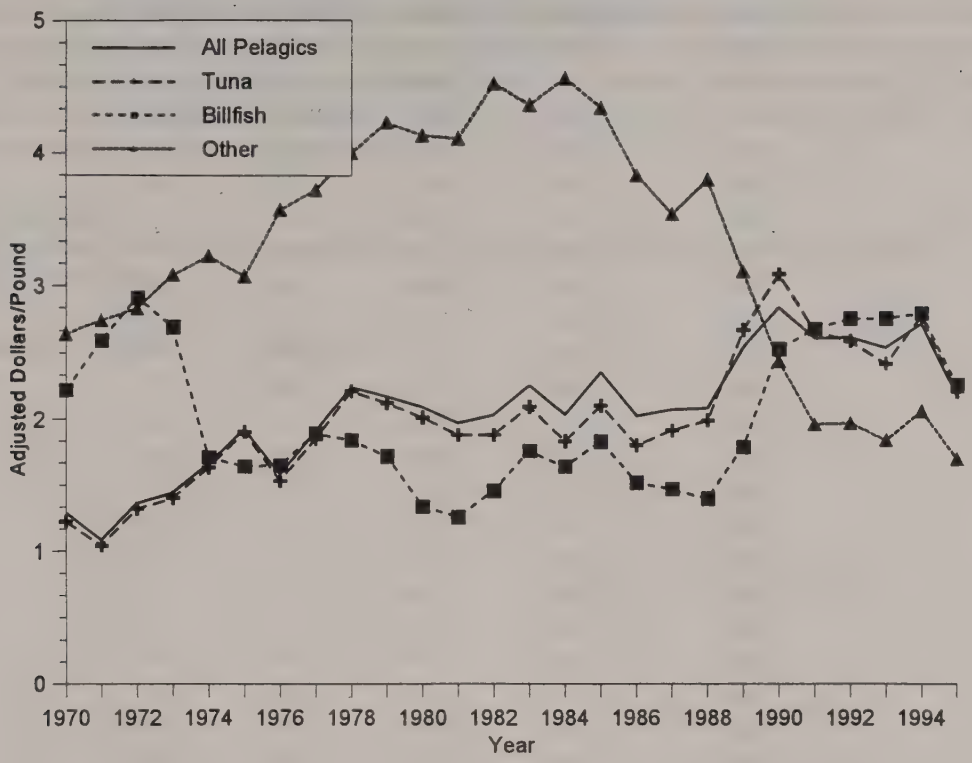
Data are compiled from Hawaii Division of Aquatic Resources (HDAR) commercial catch reports for non-longline landings and from NMFS estimates of longline landings. Inflation-adjusted revenue is computed from the Honolulu consumer price index (CPI) as: (Current year CPI / data year CPI) * data year nominal price.

Interpretation

The landings data show the effect of the dramatic increase in longline landings since the mid-1980s but the inflation-adjusted revenue indicate a potential supply-demand relationship which would weaken average prices.

Data Source: HTOT95A.cal (6/4/96)

Figure 2. Inflation-adjusted[1] ex-vessel pelagic prices



[1] Nominal annual average prices adjusted for inflation to most current year Honolulu consumer price index level. (All data must be updated annually.)

Inflation-adjusted ex-vessel pelagic prices [1]

Year	All Pelagics	Tuna	Billfish	Other
1970	1.29	1.22	2.22	2.64
1971	1.08	1.04	2.59	2.74
1972	1.36	1.32	2.91	2.83
1973	1.44	1.40	2.69	3.08
1974	1.66	1.63	1.71	3.22
1975	1.92	1.90	1.64	3.07
1976	1.58	1.53	1.65	3.57
1977	1.91	1.85	1.89	3.72
1978	2.24	2.21	1.84	4.00
1979	2.17	2.12	1.72	4.23
1980	2.09	2.01	1.34	4.13
1981	1.97	1.88	1.26	4.11
1982	2.03	1.88	1.46	4.52
1983	2.25	2.09	1.76	4.36
1984	2.03	1.83	1.64	4.56
1985	2.35	2.10	1.83	4.34
1986	2.02	1.80	1.52	3.83
1987	2.07	1.91	1.47	3.54
1988	2.08	1.99	1.40	3.80
1989	2.54	2.67	1.79	3.11
1990	2.84	3.09	2.53	2.44
1991	2.61	2.67	2.68	1.96
1992	2.62	2.59	2.76	1.97
1993	2.54	2.42	2.76	1.84
1994	2.72	2.78	2.80	2.06
1995	2.18	2.21	2.26	1.70
Average	2.06	2.01	2.01	3.28
Standard Deviation	0.45	0.49	0.52	0.89

[1] All years' inflation-adjusted price data must be updated annually.

Data

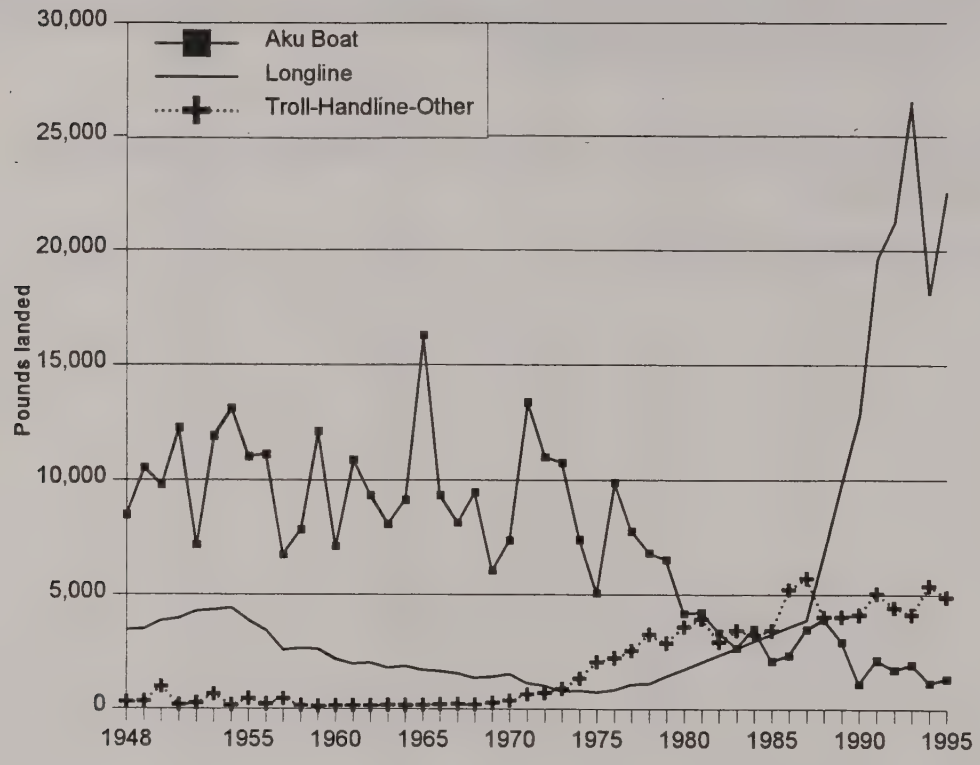
Data are compiled from Hawaii Division of Aquatic Resources (HDAR) commercial catch reports. Nominal price is calculated as (ex vessel) revenue / pounds sold. Inflation-adjusted price is calculated from the Honolulu consumer price index (CPI) as: (Current year CPI / data year CPI) * data year nominal price. No adjustment is made in this table for product form (e.g., most swordfish prices in HDAR are reported as headed, gilled, and gutted, not raised to whole weights. This increases the reported average billfish price.

Interpretation

Prices declined for all major species groups. No further information on price movement is available at this time.

Data source: PPRICE.CAL (6/28/96)

Figure 3a. Hawaii commercial pelagic landings by major gear types, 1948-1995.



Hawaii Commercial Landings, 1948-1975

	Aku boat	Longline	Troll-Handline-Other
1948	8,496	3,476	297
1949	10,541	3,491	332
1950	9,788	3,859	976
1951	12,264	3,970	183
1952	7,181	4,290	247
1953	11,914	4,332	646
1954	13,104	4,448	161
1955	11,020	3,898	449
1956	11,120	3,443	217
1957	6,765	2,571	453
1958	7,856	2,645	156
1959	12,122	2,636	132
1960	7,138	2,173	150
1961	10,878	1,972	148
1962	9,349	2,022	154
1963	8,096	1,811	171
1964	9,134	1,883	167
1965	16,295	1,707	170
1966	9,339	1,655	198
1967	8,164	1,563	226
1968	9,463	1,353	195
1969	6,072	1,416	273
1970	7,386	1,541	379
1971	13,393	1,151	654
1972	11,001	1,055	710
1973	10,766	778	885
1974	7,427	830	1,347
1975	5,088	746	2,060

Hawaii Commercial Pelagic Landings, 1976-1995

	Aku Boat	Longine	Troll-Handline-Other
1976	9,896	838	2,241
1977	7,780	1,101	2,548
1978	6,849	1,125	3,272
1979	6,549	1,432	2,889
1980	4,194	1,740	3,592
1981	4,229	2,047	3,947
1982	3,342	2,355	2,941
1983	2,683	2,663	3,442
1984	3,527	2,970	3,257
1985	2,114	3,278	3,439
1986	2,351	3,585	5,232
1987	3,503	3,893	5,737
1988	3,943	6,733	4,038
1989	2,962	9,844	4,046
1990	1,116	12,790	4,128
1991	2,146	19,600	5,054
1992	1,735	21,240	4,439
1993	1,966	26,510	4,147
1994	1,160	18,100	5,415
1995	**1,340**	**22,550**	**4,910**

Data

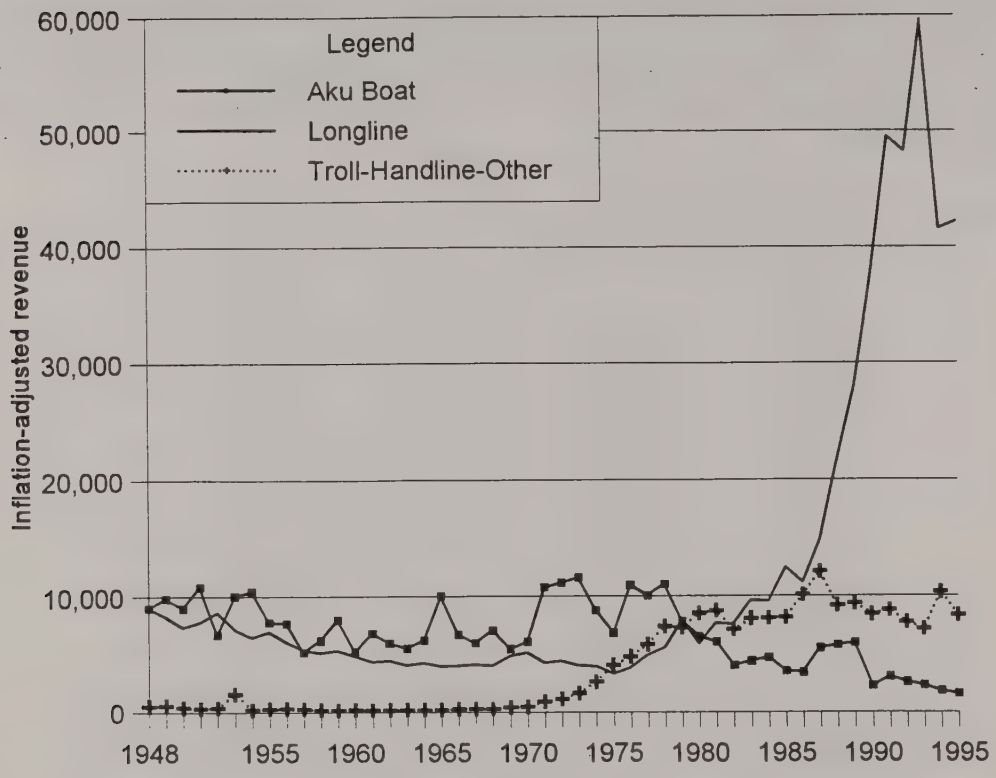
NMFS compilation based on HDAR commercial catch reports for all non-longline gears and NMFS estimates of longline landings from 1979 to present.

Interpretation

This graph shows the long-term decline of the baitboat (Pole-and-line skipjack tuna) fleet from the immediate post World War II period, beginning in the mid-1970s. It also shows the rise of the commercial troll and handline pelagic fisheries in the mid-1979s and the recovery and subsequent rapid rise of the longline fishery in the mid-1980s. The longline fishery is now by far the largest fishery in Hawaii.

Data source: HTOT95A.cal (6/4/96)

Figure 3b. Hawaii commercial pelagic inflation-adjusted ex-vessel revenue by major gear types, 1948-1995.



Inflation-adjusted Revenue, Hawaii commercial pelagic fishery, 1948-1995

	Aku boat	Longline	Troll-Handline-Other
1948	9,058	9,059	547
1949	9,900	8,310	590
1950	9,026	7,382	412
1951	10,852	7,842	309
1952	6,734	8,641	383
1953	10,073	7,171	1,584
1954	10,464	6,488	213
1955	7,843	7,006	304
1956	7,734	6,132	312
1957	5,228	5,419	284
1958	6,231	5,164	209
1959	8,031	5,359	166
1960	5,277	4,896	217
1961	6,846	4,377	195
1962	6,020	4,498	211
1963	5,545	4,125	202
1964	6,250	4,310	206
1965	10,081	3,990	202
1966	6,748	4,052	259
1967	6,006	4,132	276
1968	7,083	4,053	288
1969	5,492	4,903	409
1970	6,123	5,156	470
1971	10,815	4,298	900
1972	11,217	4,460	1,130
1973	11,661	4,071	1,631
1974	8,809	3,983	2,620
1975	6,877	3,334	4,062

(Table continued on next page)

Inflation-adjusted Revenue (Hawaii commercial pelagic fishery, 1948-95 [000's])

	Alo boat	Longline	Troll-Handline-Other
1976	10,980	1,[illegible]	[illegible]
1977	10,079	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]
1979	[illegible]	[illegible]	[illegible]
1980	[illegible]	[illegible]	[illegible]
1981	[illegible]	[illegible]	[illegible]
1982	4,051	[illegible]	[illegible]
1983	4,409	[illegible]	[illegible]
1984	4,738	[illegible]	[illegible]
1985	3,966	[illegible]	[illegible]
1986	1,442	[illegible]	[illegible]
1987	5,551	[illegible]	[illegible]
1988	1,810	[illegible]	[illegible]
1989	5,309	[illegible]	[illegible]
1990	2,300	[illegible]	[illegible]
1991	3,064	49,547	8,811
1992	2,631	48,278	7,771
1993	2,322	59,654	7,181
1994	1,863	41,592	3,364
1995	1,609	42,200	3,366

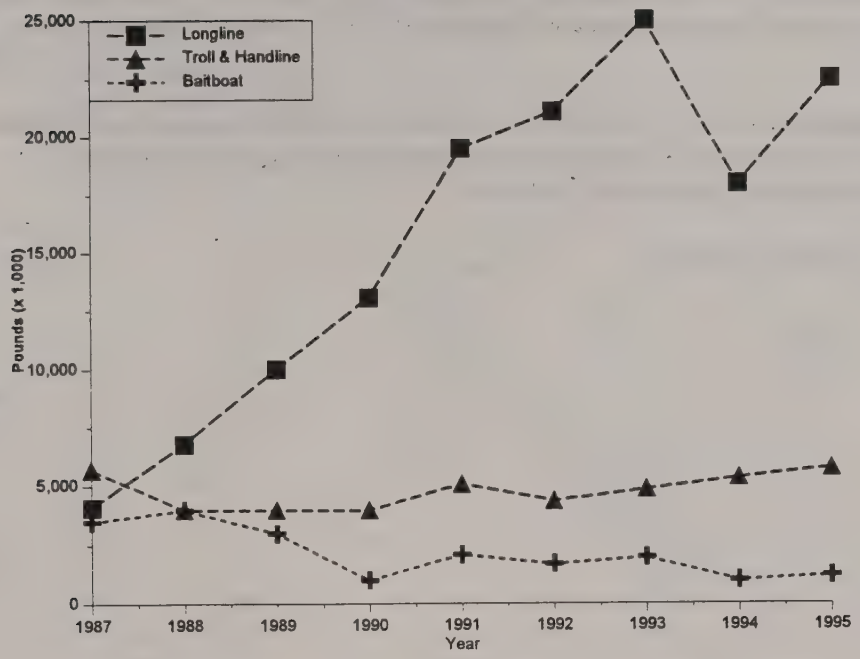
Data

Data source is the same as previous table.

Interpretation

On an inflation adjusted revenue basis, the dominance of the longline fishery in Hawaii is accentuated.

Figure 4. Hawaii total commercial pelagic landings by gear type.



	Pounds landed (x 1,000)		
Year	Longline	Troll-Handline-Other	Baitboat
1987	4,100	5,700	3,500
1988	6,800	4,000	4,000
1989	10,000	4,000	3,000
1990	13,100	4,000	1,000
1991	19,500	5,100	2,100
1992	21,100	4,400	1,700
1993	25,000	4,900	2,000
1994	18,000	5,400	1,000
1995	**22,500**	**5,700**	**1,200**
Mean	15,567	4,800	2,167
Standard Deviation	6,948	680	1,040

Data

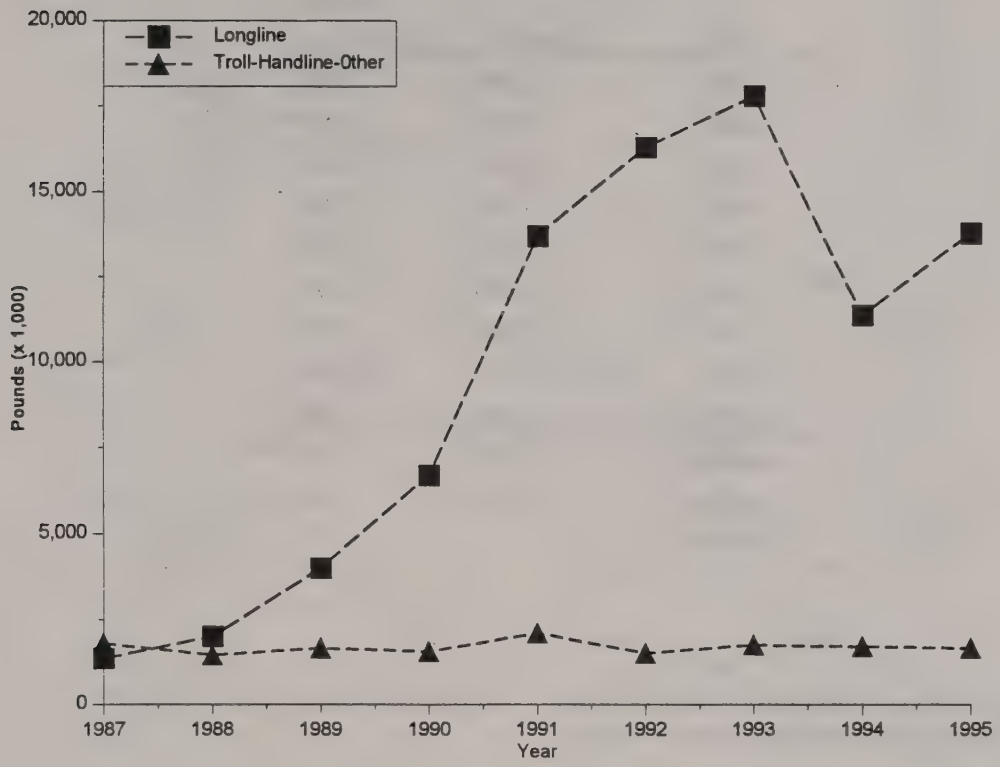
Longline landings are compiled from NMFS estimates based on market monitoring and, since 1991, Federal logbooks. Troll & Handline landings, and Baitboat (Pole-and-line skipjack tuna) landings are from Hawaii Division of Aquatic Resources (HDAR) commercial catch reports.

Interpretation

The Hawaii longline fishery returned to its early 1990s heights in 1995, with increased emphasis on tuna landings. Troll & handline landings were higher than the long-term average while baitboat landings remained at historically low levels.

Data Source: N8795P.cal (7/2/96)

Figure 5. Hawaii commercial billfish and other non-tuna PMUS landings by gear type.



Hawaii commercial billfish and other non-tuna PMUS landings by gear type.

	Pounds Landed (x 1,000)	
Year	Longline	Troll & Handline
1987	1,350	1,800
1988	2,000	1,450
1989	4,000	1,650
1990	6,700	1,550
1991	13,700	2,100
1992	16,300	1,500
1993	17,800	1,750
1994	11,400	1,700
1995	**13,800**	**1,650**
Average	9,672	1,683
Standard Deviation	6,279	194

Data

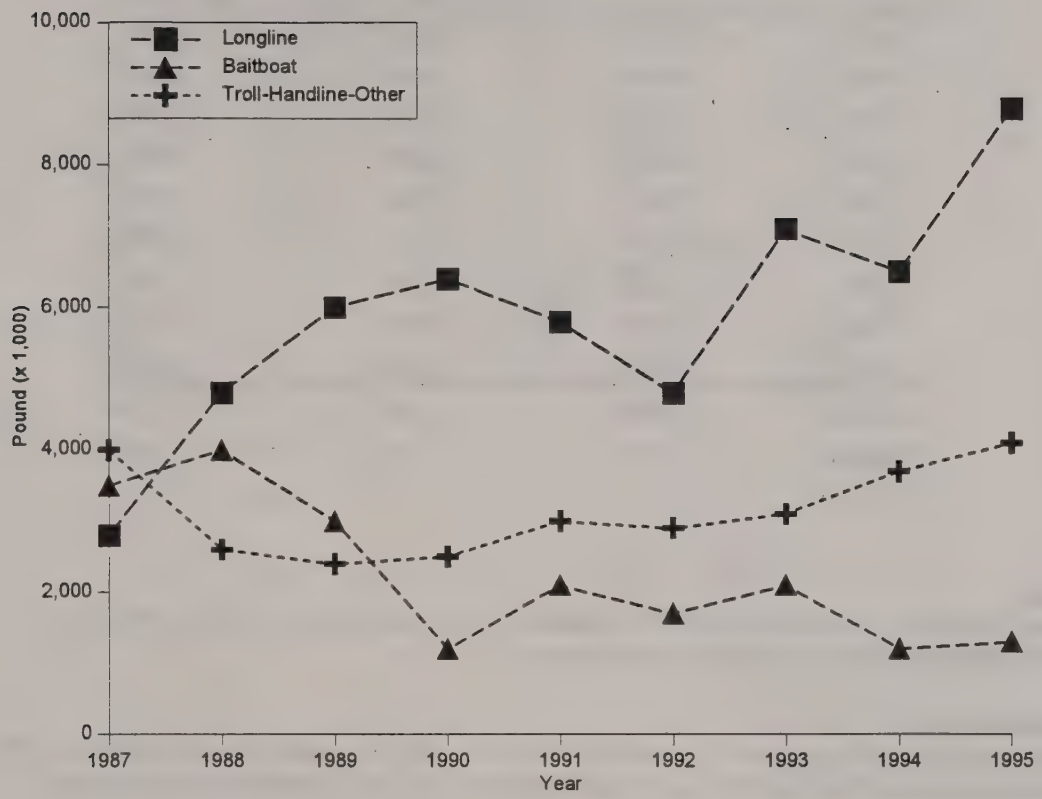
Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports.

Interpretation

The swordfish component of the longline fishery rose rapidly in the early 1990s, with a significant decline in 1994. The apparent "recovery" in 1995 is from other species, not swordfish, which continued to decline as a target in 1995. Troll-handline landings were in their usual range in 1995.

Data Source: N8795P.cal (7/2/96)

Figure 6. Hawaii commercial tuna landings by gear type.



Hawaii commercial tuna landings by gear type.

Year	Pounds Landed (x 1,000)		
	Longline	Baitboat	Troll-Handline-Other
1987	2,800	3,500	4,000
1988	4,800	4,000	2,600
1989	6,000	3,000	2,400
1990	6,400	1,200	2,500
1991	5,800	2,100	3,000
1992	4,800	1,700	2,900
1993	7,100	2,100	3,100
1994	6,500	1,200	3,700
1995	**8,800**	**1,300**	**4,100**
Average	5,889	2,233	3,144
Standard Deviation	1,677	1,039	642

Data

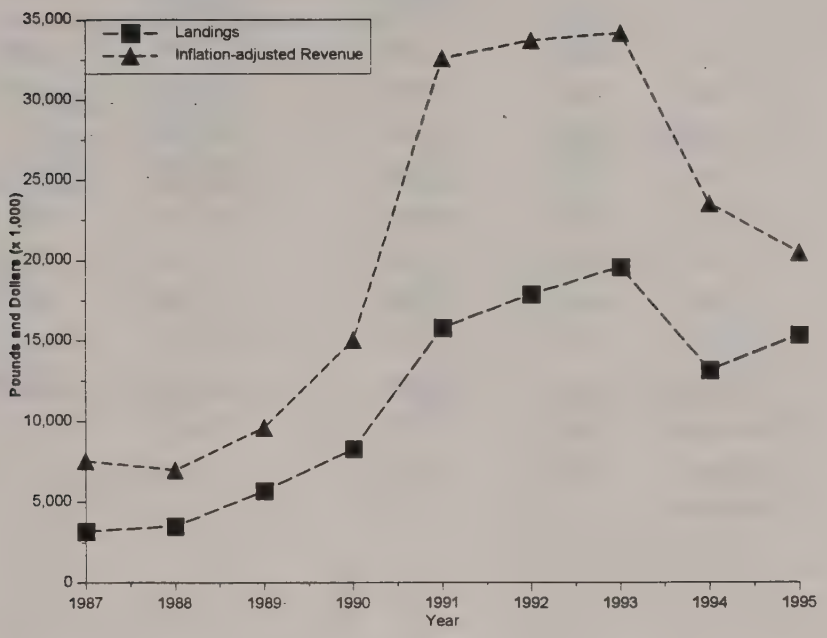
Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports.

Interpretation

Longline fishing effort increasingly focused on tuna as a target species (as described in Ito, 1996). Troll-handline landings reached a new peak since 1967 and were higher than the long-term average.

Data Source: N8795P.cal (7/2/96)

Figure 7. Hawaii billfish & other non-tuna PMUS landings and revenue.



Hawaii billfish & other non-tuna PMUS landings and revenue.

Year	Pounds (x 1,000)	Nominal Revenue ($,1000)	Inflation-adjusted Revenue ($1,000)	HCPI
1987	3,200	5,200	7,560	116
1988	3,500	5,100	6,998	123
1989	5,700	7,400	9,614	130
1990	8,300	12,400	15,043	139
1991	15,800	28,800	32,593	149
1992	17,900	31,200	33,724	156
1993	19,600	32,600	34,184	161
1994	13,200	23,000	23,575	164
1995	**15,400**	**20,500**	**20,500**	**169**
Average	11,400	18,467	20,421	
Standard Deviation	6,323	11,221	11,268	

Data

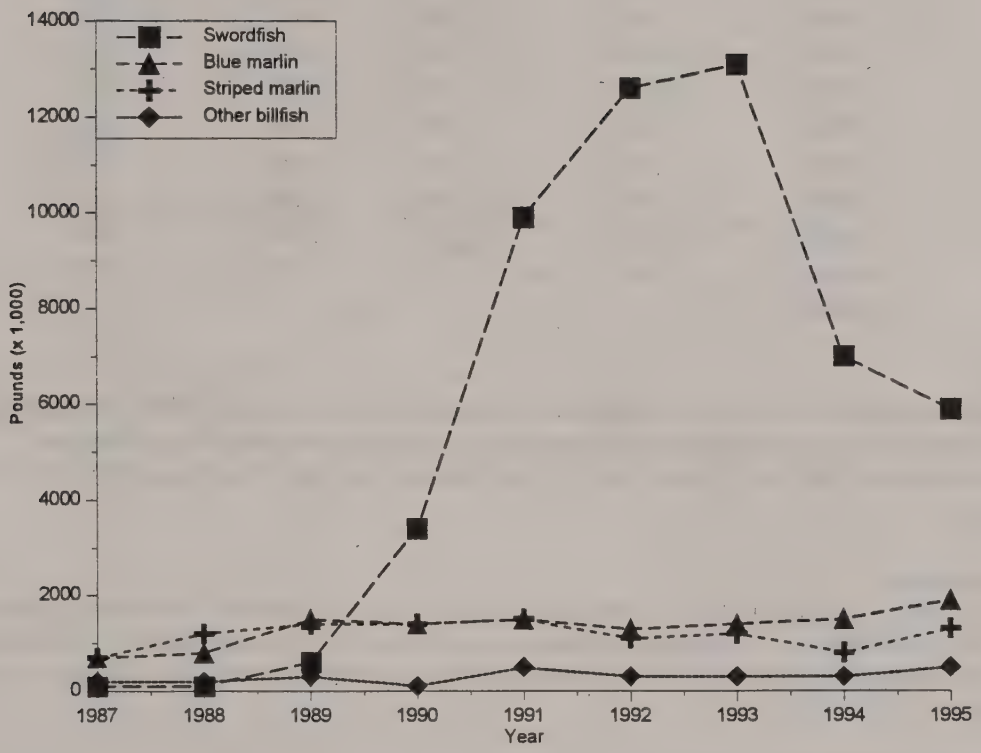
Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports.

Interpretation

Although 1994 and 1995 marked a significant decline in non-tuna landings by all gears, most of the decline is attributable to the decline in longline swordfish landings. Swordfish landings declined primarily because of a shift to targeting tunas. The 1995 landings remained above the recent term average and inflation-adjusted revenue is at the long-term average.

Data Source: N8795P.cal (7/2/96)

Figure 8. Species composition of Hawaii commercial billfish landings.



Year	Pounds Landed (x 1,000)			
	Swordfish	Blue marlin	Striped marlin	Other billfish
1987	100	700	700	200
1988	100	800	1,200	200
1989	600	1,500	1,400	300
1990	3,400	1,400	1,400	100
1991	9,900	1,500	1,500	500
1992	12,600	1,300	1,100	300
1993	13,100	1,400	1,200	300
1994	7,000	1,500	800	300
1995	**5,900**	**1,900**	**1,300**	**500**
Average	5,856	1,333	1,178	300
Standard Deviation	5,191	371	273	132

Data

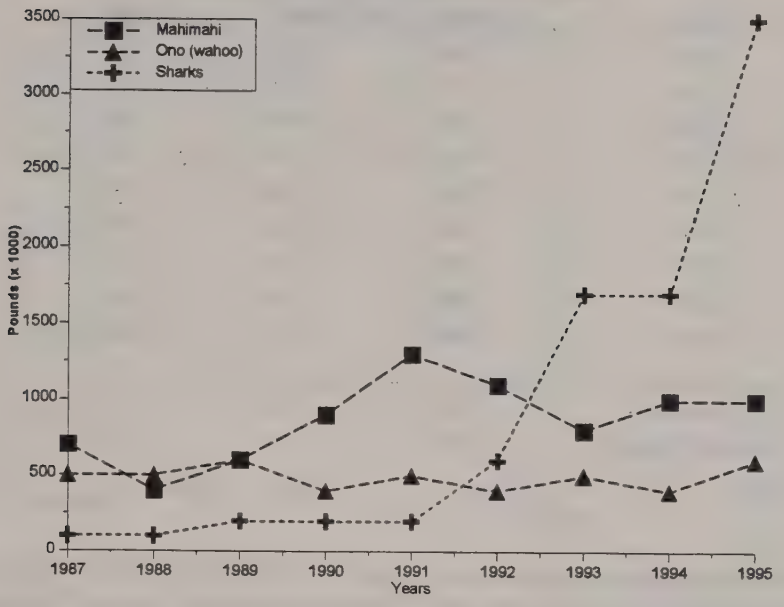
Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds.

Interpretation

The swordfish component of the longline fishery rose rapidly in the early 1990s, with a significant decline in 1994 and 1995. Blue marlin landings were above the long-term average. Other species were within their recent ranges. The swordfish decline was caused by the shift in targeting to tuna species.

Data Source: N8795P.cal (7/2/96)

Figure 9. Hawaii commercial landings -- mahimahi, ono (wahoo), and sharks.



Hawaii commercial landings -- mahimahi, ono(wahoo), and sharks.

	Pounds (x 1,000)		
Year	**Mahimahi**	**Ono (Wahoo)**	**Sharks**
1987	700	500	100
1988	400	500	100
1989	600	600	200
1990	900	400	200
1991	1,300	500	200
1992	1,100	400	600
1993	800	500	1,700
1994	1,000	400	1,700
1995	**1,000**	**600**	**3,500**
Average	850	500	922
Standard Deviation	288	76	1,166

Data

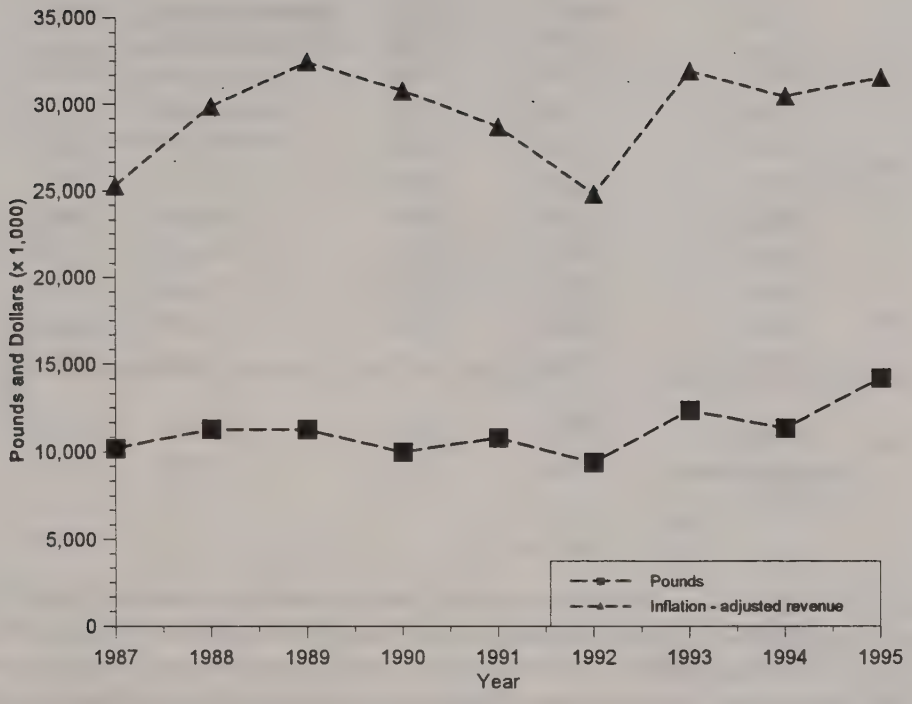
Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds.

Interpretation

Mahimahi and ono landings are within their recent ranges. Shark landings represent reported weights for troll-handline-other gears and NMFS estimates of round or whole weights for longline caught shark, including sharks "finned" (where only the fins are retained and the carcasses are discarded at sea). In 1995, 70,000 sharks were caught, of which 33,300 were kept: 3,300 sharks were kept as *whole* shark product and 30,000 were processed as a finned product. Shark fins are estimated to weigh 49,000 pounds in processed weight while the whole sharks totaled 125,000 pounds. Estimated *round* weight of all sharks "kept" was 3.5 million pounds.

Data Source: N8795P.cal (7/2/96)

Figure 10. Hawaii tuna landings and revenue.



Hawaii tuna landings and revenue.

Year	Pounds Landed (x 1,000)	Nominal Revenue x $1,000	Inflation-adjusted Revenue x $1,000	HCPI
1987	10,200	17,400	25,298	115.90
1988	11,300	21,800	29,915	122.80
1989	11,300	25,000	32,481	129.70
1990	10,000	25,400	30,815	138.90
1991	10,800	25,400	28,745	148.90
1992	9,400	23,000	24,860	155.90
1993	12,400	30,500	31,982	160.70
1994	11,400	29,800	30,545	164.40
1995	14,300	31,600	31,600	168.51
Average	11,233	25,544	29,582	
Standard Deviation	1,455	4,562	2,787	

Data

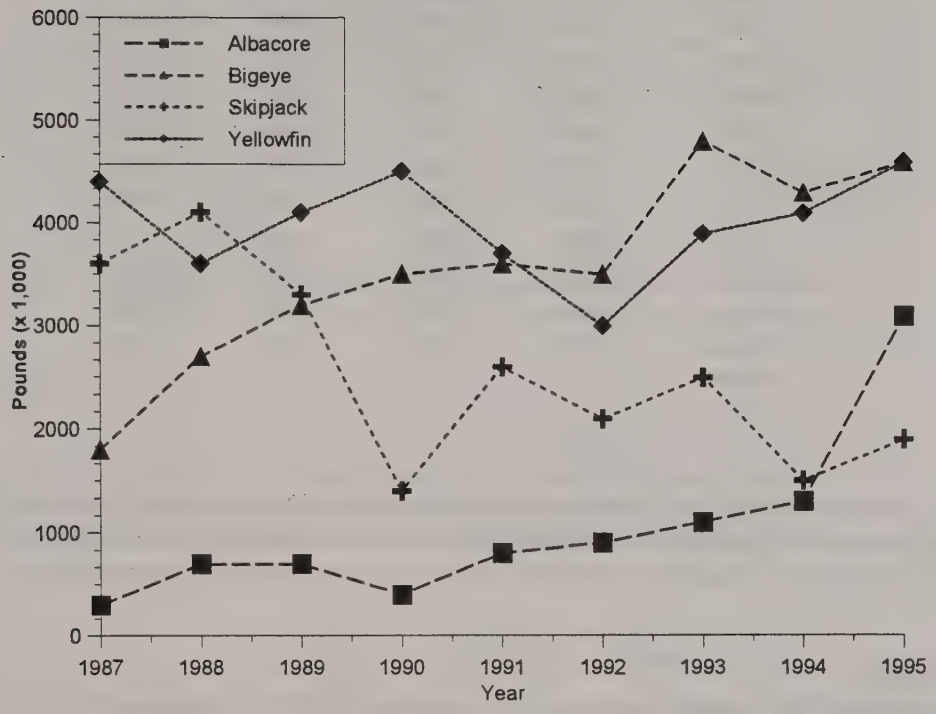
Commercial landings and ex vessel revenue for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds. Inflation-adjusted revenue bases previous year's revenues on the current year (1995) Honolulu consumer price index (HCPI).

Interpretation

Tuna landings in the Hawaii commercial fishery are at an all time high, as in nominal (but not inflation-adjusted) ex vessel revenue. Troll-handline-other landings of tuna are above recent averages (with particularly good landings of albacore. Aku boat (pole-and-line skipjack tuna) landings remain depressed, and longline is at historic highs for Hawaii.

Data Source: N8795P.cal (7/2/96)

Figure 11. Species composition of Hawaii commercial tuna landings.



Species composition of Hawaii commercial tuna landings.

	Pounds Landed (x 1,000)			
Year	**Albacore**	**Bigeye**	**Skipjack**	**Yellowfin**
1987	300	1,800	3,600	4,400
1988	700	2,700	4,100	3,600
1989	700	3,200	3,300	4,100
1990	400	3,500	1,400	4,500
1991	800	3,600	2,600	3,700
1992	900	3,500	2,100	3,000
1993	1,100	4,800	2,500	3,900
1994	1,300	4,300	1,500	4,100
1995	3,100	4,600	1,900	4,600
Average	1,033	3,556	2,556	3,989
Standard Deviation	835	945	944	506

Data

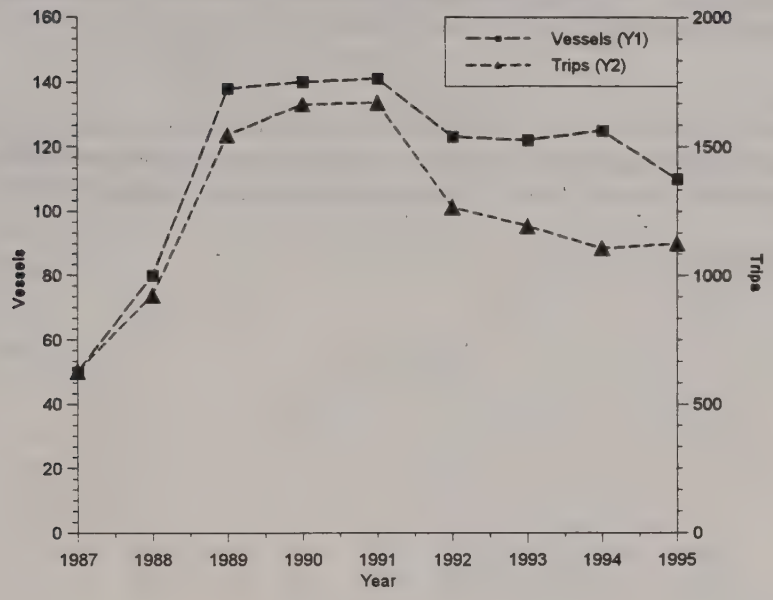
Species summaries for all gears combined are compiled from HDAR and NMFS landings figures. Longline data are compiled from NMFS estimates. Troll-handline-other pelagics data are compiled from HDAR commercial catch reports. Data are rounded to the nearest 100,000 pounds.

Interpretation

Albacore, bigeye, and yellowfin were at or near recent peaks in 1995. Longline albacore is at an historic high, and longline bigeye and yellowfin are near recent peaks. Troll-handline landings of albacore were also at record levels. The increase in this latter category was because of substantial landings of albacore by distant-water trollers (9,500 pounds by trolling, 337,000 pounds by Hawaii-style handline gears, and 815,000 pounds by distant-water trollers).

Data Source: N8795P.cal (7/2/96)

Figure 12. Hawaii longline vessel activity.



Year	Active Vessels	Trips
1986	37	435
1987	50	627
1988	80	923
1989	138	1,546
1990	140	1,664
1991	141	1,670
1992	123	1,265
1993	122	1,192
1994	125	1,107
1995	110	1,125
Average	105	1,161
Standard Deviation	37	414

Data

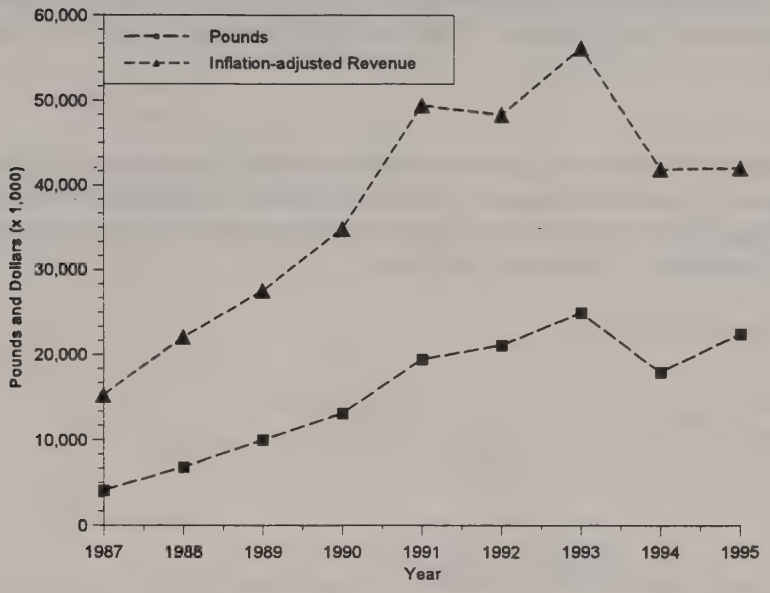
Longline fishing effort data are compiled from Federal logbooks collected by the Fishery Monitoring & Economics Program of the NMFS Honolulu Laboratory for the year 1991-present, and by shoreside monitoring by FMEP in earlier years.

Interpretation

Although the number of active longline vessels has subsided in recent years, they remain above the average for participation since the mid-1980s. Longline trip activity increased slightly in 1995 but remains substantially below the 1990-91 peak when limited entry into the fishery was introduced.

Data Source: LL95B.cal (6/28/96)

Figure 13. Hawaii longline landings and revenue.



Year	Pounds (x 1,000)	Nominal Revenue ($1,000)	Adjusted Revenue ($1,000)	Honolulu Consumer Price Index
1987	4,100	10,500	15,266	115.90
1988	6,800	16,100	22,093	122.80
1989	10,000	21,200	27,544	129.70
1990	13,100	28,700	34,818	138.90
1991	19,500	43,700	49,455	148.90
1992	21,100	44,700	48,316	155.90
1993	25,000	53,600	56,205	160.70
1994	18,000	40,900	41,923	164.40
1995	22,500	42,100	42,100	169
Average	15,567	33,500	37,524	
Standard Deviation	7,370	14,867	13,641	

Data

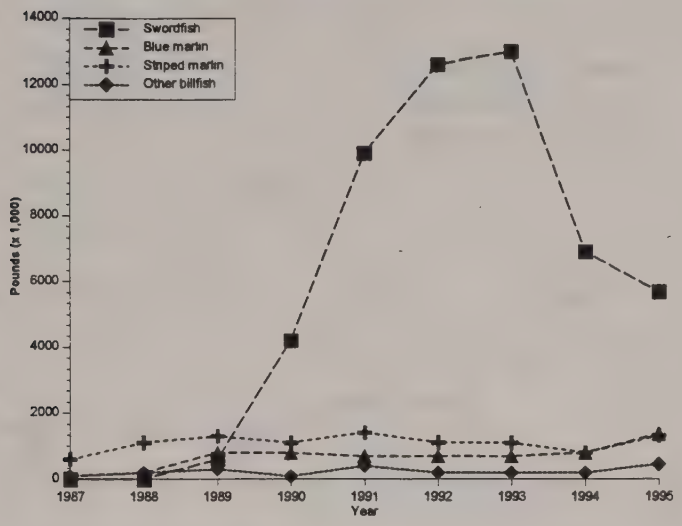
Longline landings and ex vessel revenue estimates are compiled by the NMFS Honolulu Laboratory. They represent weight estimates using Federal logbooks (since 1991) and market monitoring average weight per fish figures. Prior to 1991, estimates rely on NMFS shoreside and market monitoring.

Interpretation

The Hawaii longline fishery has been stable for the past two years, following a significant decline from 1992-93 peaks. Most of the change is due to the swordfish component of the longline fishery which rose rapidly in the early 1990s, with a significant decline in 1994 as swordfish longliners shifted their effort to tuna or left the fishery.

Data Source: N8795P.cal (7/2/96)

Figure 14. Hawaii longline landings -- all billfish.



	Pounds Landed (x 1,000)			
Year	**Swordfish**	**Striped marlin**	**Blue marlin**	**Other billfish**
1987	0	600	100	100
1988	0	1,100	200	200
1989	600	1,300	800	300
1990	4,200	1,100	800	100
1991	9,900	1,400	700	400
1992	12,600	1,100	700	200
1993	13,000	1,100	700	200
1994	6,900	800	800	200
1995	**5,840**	**1,200**	**1,260**	**450**
Average	5,893	1,078	673	239
Standard Deviation	5,159	244	344	122

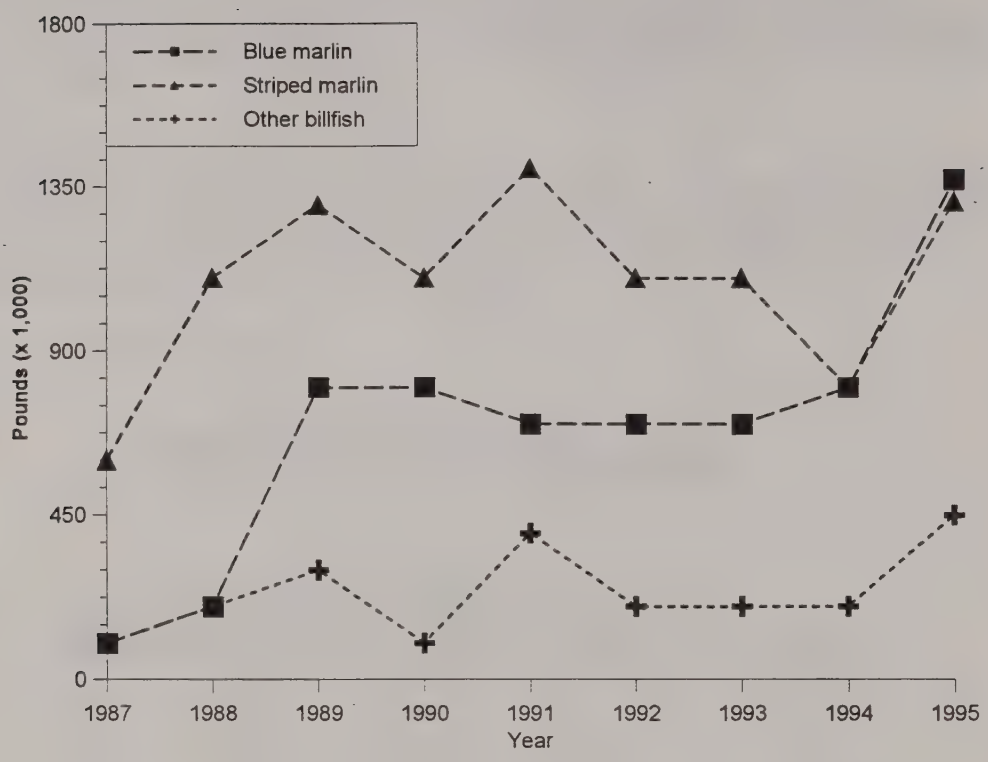
Data

Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory staff.

Interpretation

The dramatic decline in swordfish landings represents the change in targetting practices. A separate report has been prepared on this subject. Blue marlin was well above the long-term average. Other species are within their recent ranges.

Figure 14a. Hawaii longline landings -- other billfish.



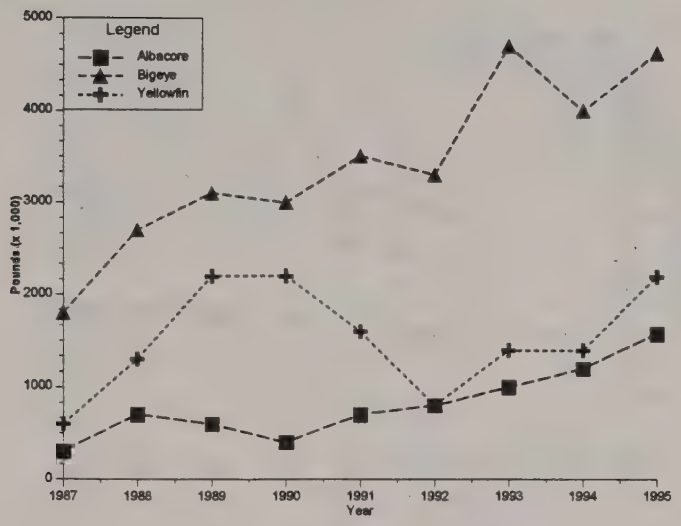
Data

Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory staff.

Interpretation

Blue and striped marlin catches increased as the longline fishery returned to targetting tuna, for which these species are a by catch.

Figure 15. Hawaii longline landings – tunas.



Year	Pounds Landed (x 1,000)		
	Albacore	**Bigeye**	**Yellowfin**
1987	300	1,800	600
1988	700	2,700	1,300
1989	600	3,100	2,200
1990	400	3,000	2,200
1991	700	3,500	1,600
1992	800	3,300	800
1993	1,000	4,700	1,400
1994	1,200	4,000	1,400
1995	1,950	4,520	2,100
Average	850	3,402	1,511
Standard Deviation	496	910	582

Data

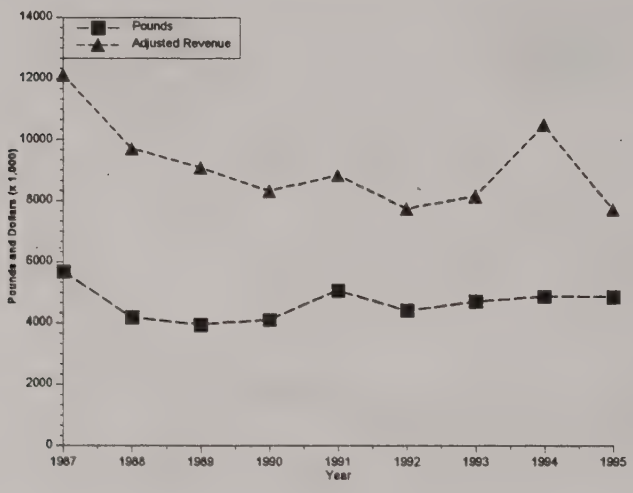
Data are compiled from Federal logbooks and market monitoring information by NMFS Honolulu Laboratory staff.

Interpretation

All tuna species show increasing landings over the past four years as targetting towards tunas has returned.

Source: LL95b.cal (3/16/96)

Figure 16. Hawaii troll and handline landings and revenue (pelagic species).



Year	Pounds (x 1,000)	Nominal Revenue ($1,000)	Adjusted Revenue ($1,000)	HCPI
1987	5,696	8,340	12,126	115.90
1988	4,194	7,074	9,707	122.80
1989	3,958	7,000	9,095	129.70
1990	4,111	6,859	8,321	138.90
1991	5,066	7,796	8,823	148.90
1992	4,412	7,149	7,727	155.90
1993	4,710	7,755	8,132	160.70
1994	5,410	10,200	10,455	164.40
1995	**4,860**	**7,700**	**7,700**	**168.51**
Average	4,713	7,764	9,121	
Standard Deviation	601	1,032	1,450	

Data

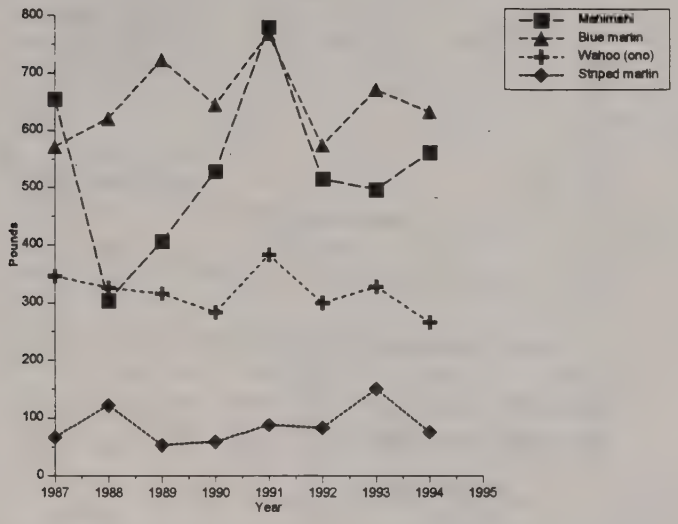
Data are compiled from HDAR commercial catch reports.

Interpretation

Landings and ex-vessel revenue are within their recent ranges for the combined troll-handline fishery.

Source: TRHL94s. Cal (3/16/96)

Figure 17. Hawaii commercial troll and handline landings -- non-tuna PPMUS.



	Pounds Landed (x 1,000)			
Year	**Mahimahi**	**Blue marlin**	**Ono(wahoo)**	**Striped marlin**
1987	655	571	346	66
1988	304	621	326	122
1989	407	724	316	53
1990	529	645	284	59
1991	781	769	383	88
1992	515	574	300	83
1993	497	672	328	151
1994	612	660	286	78
1995	**446**	**579**	**481**	**91**
Average	527	646	339	88
Standard Deviation	141	69	62	31

Data

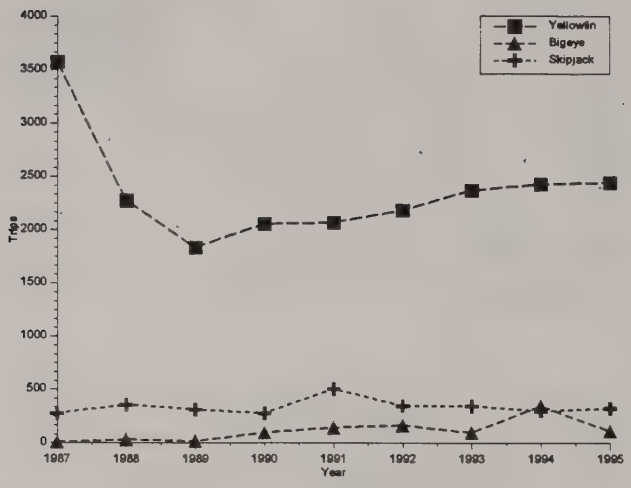
Data are compiled from HDAR commercial catch reports.

Interpretation

Landings for all non-tuna species are within their recent ranges for the combined troll-handline fishery, except for ono (wahoo) which was above the long-term average.

Source: TRHL94s.cal (3/16/96)

Figure 18. Hawaii commercial troll and handline landings -- tunas.



Year	Pounds Landed (x 1,000)		
	Yellowfin	Bigeye	Skipjack
1987	3,575	6	275
1988	2,275	31	355
1989	1,837	19	313
1990	2,054	97	275
1991	2,066	142	504
1992	2,182	164	347
1993	2,367	98	345
1994	2,774	361	325
1995	**2,444**	**113**	**326**
Average	2,397	115	341
Standard Deviation	517	107	68

Data

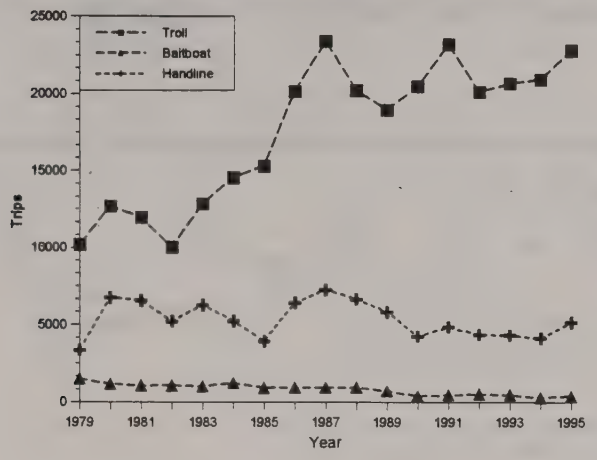
Data are compiled from HDAR commercial catch reports.

Interpretation

Landings of the traditional tuna species are within their recent ranges for the combined troll-handline fishery.

Source: TRHL94s.cal (3/16/96)

Figure 19. Hawaii commercial pelagic trips by non-longline gears.



Year	Number of Trips		
	Troll	Baitboat	Handline
1979	10,185	1,495	3,346
1980	12,692	1,149	6,746
1981	11,975	1,059	6,562
1982	10,039	1,067	5,219
1983	12,842	1,014	6,275
1984	14,556	1,232	5,248
1985	15,291	924	3,929
1986	20,139	941	6,412
1987	23,391	938	7,263
1988	20,202	941	6,647
1989	18,924	723	5,834
1990	20,468	378	4,261
1991	23,184	463	4,861
1992	20,109	510	4,374
1993	20,647	477	4,343
1994	20,905	281	4,142
1995	**22,792**	**373**	**5,165**
Average	17,549	821	5,331
Standard Deviation	4,653	352	1,170

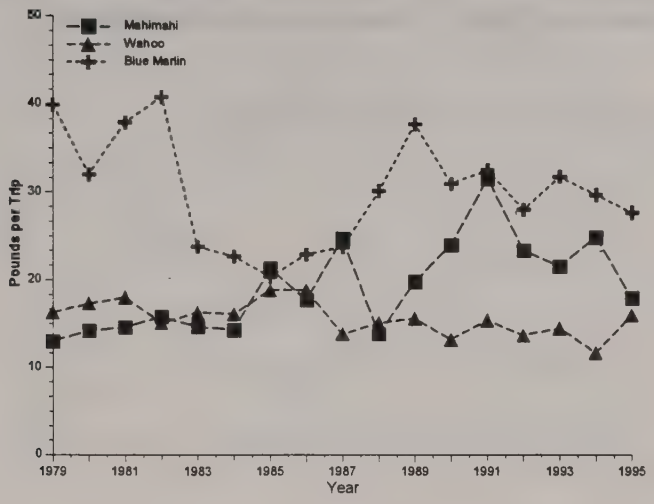
Data

Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation

Activity by these gear types was within their usual range, except baitboat which was below the long-term average.

Figure 20. Commercial trolling catch per trip -- mahimahi, wahoo and blue marlin.



	Pounds Caught per Trolling Trip		
Year	Mahimahi	Ono (Wahoo)	Blue Marlin
1979	13.0	16.3	39.9
1980	14.2	17.3	32.0
1981	14.6	18.0	37.9
1982	15.8	15.1	40.8
1983	14.7	16.3	23.8
1984	14.3	16.1	22.7
1985	21.3	18.8	20.3
1986	17.7	18.8	22.9
1987	24.7	13.8	23.7
1988	13.8	15.1	30.1
1989	19.8	15.6	37.7
1990	24.0	13.2	30.9
1991	31.5	15.4	32.5
1992	23.4	13.7	28.0
1993	21.6	14.5	31.8
1994	24.9	11.7	29.7
1995	**18.0**	**16.2**	**27.7**
Average	19.3	15.6	30.1
Standard Deviation	5.2	1.9	6.3

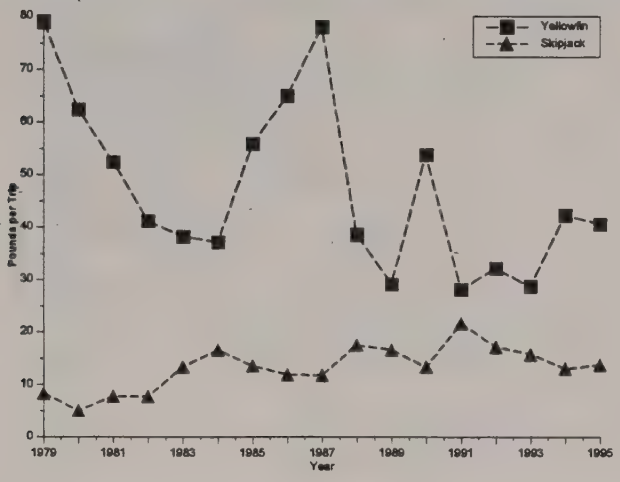
Data

Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation

Catch rates for these species was within their usual range in 1995.

Figure 20a. Commercial trolling catch per trip -- yellowfin & skipjack tuna

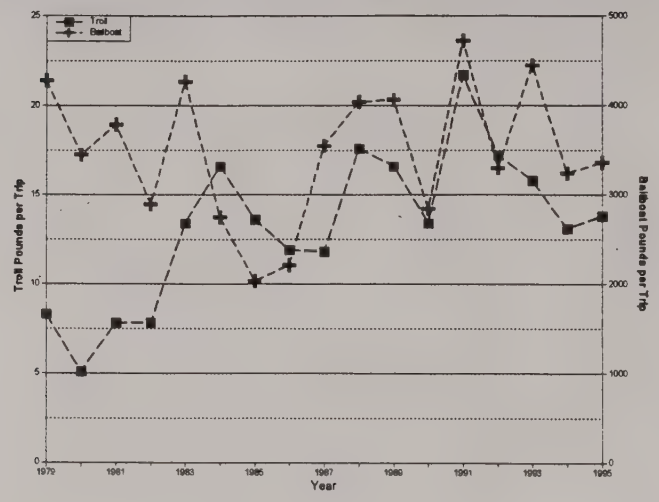


	Pounds Caught per Trolling Trip	
Year	**Yellowfin**	**Skipjack**
1979	7.9	8.3
1980	62.5	5.1
1981	52.5	7.8
1982	41.3	7.8
1983	38.3	13.4
1984	37.2	16.6
1985	55.9	13.6
1986	65.1	11.9
1987	78.1	11.8
1988	38.7	17.6
1989	29.2	16.6
1990	53.9	13.4
1991	28.2	21.7
1992	32.3	17.2
1993	28.9	15.8
1994	42.4	13.1
1995	**40.7**	**13.8**
Average	43.1	13.3
Standard	**16.3**	**4.1**

Data
Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation
Catch rates for yellowfin and skipjack tuna have returned to their long-term avarage after several low years.

Figure 21. Baitboat & commercial trolling catch per trip -- skipjack tuna.

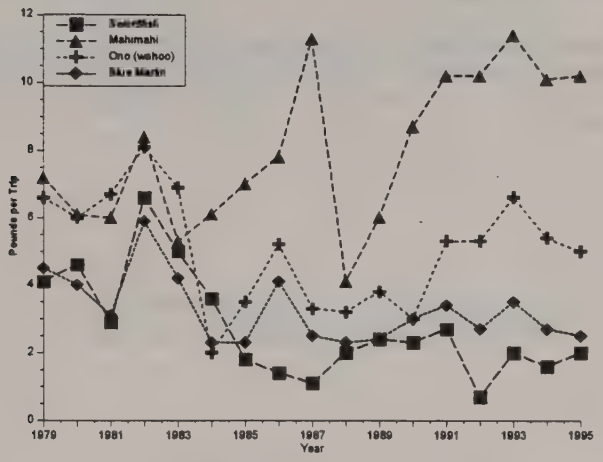


	Pounds Skipjack Caught per Trip	
Year	**Trollling**	**Baitboat**
1979	8.3	4,278
1980	5.1	3,447
1981	7.8	3,786
1982	7.8	2,892
1983	13.4	2,468
1984	16.6	2,748
1985	13.6	2,031
1986	11.9	2,206
1987	11.8	3,548
1988	17.6	4,036
1989	16.6	4,061
1990	13.4	2,840
1991	21.7	4,722
1992	17.2	3,297
1993	15.8	4,447
1994	13.1	3,240
1995	**13.8**	**3,362**
Average	13.3	3,377
Standard Deviation	4.3	784

Data
Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation
This figure shows the correspondence of baitboat and trolling catch rates for skipjack once the level of cannery catch declined substantially, beginning in the mid-1980s.

Figure 22. Combined commercial handline catch per trip -- swordfish, mahimahi, ono (wahoo), & blue marlin.

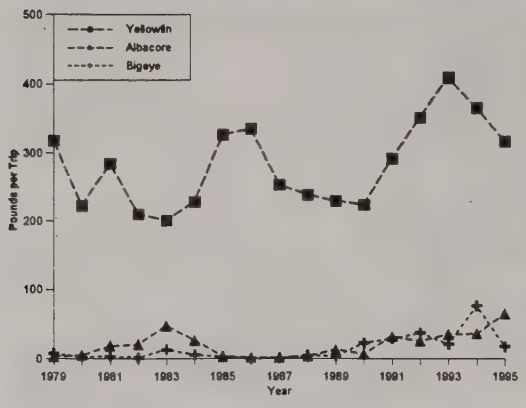


	Combined Handline Catch per Trip (lb)			
Year	**Swordfish**	**Mahimahi**	**Wahoo**	**Blue Marlin**
1979	4.1	7.2	6.6	4.5
1980	4.6	6.1	6.0	4.0
1981	2.9	6.0	6.7	3.1
1982	6.6	8.4	8.1	5.9
1983	5.0	5.3	6.9	4.2
1984	3.6	6.1	2.0	2.3
1985	1.8	7.0	3.5	2.3
1986	1.4	7.8	5.2	4.1
1987	1.1	11.3	3.3	2.5
1988	2.0	4.1	3.2	2.3
1989	2.4	6.0	3.8	2.4
1990	2.3	8.7	3.0	3.0
1991	2.7	10.2	5.3	3.4
1992	0.7	10.2	5.3	2.7
1993	2.0	11.4	6.6	3.5
1994	1.6	10.1	5.4	2.7
1995	**2.0**	**10.2**	**5.0**	**2.5**
Average	2.8	8.0	5.1	3.3
Standard Deviation	1.6	2.3	1.7	1.0

Data
Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation
Catch rates in the handline fishery remain within their recent ranges.

Figure 23. Combined commercial handline catch per trip -- yellowfin, albacore and bigeye tunas.



	Handline Catch Rate (Pounds per Trip)		
Year	**Yellowfin**	**Albacore**	**Bigeye**
1979	318	3	8
1980	222	5	2
1981	285	19	3
1982	211	21	2
1983	201	48	13
1984	229	27	6
1985	326	3	3
1986	335	2	0
1987	253	2	1
1988	238	4	5
1989	229	13	3
1990	223	7	23
1991	291	32	29
1992	350	26	38
1993	408	35	21
1994	364	37	77
1995	**316**	**65**	**18**
Average	282	20	15
Standard Deviation	62	19	19

Data
Data compiled from HDAR commercial catch report using unique license number-date combinations for species caught > 0 (i.e., does not include zero catch trips).

Interpretation
Catch rates for albacore were substantially above their recent average, while bigeye tuna catch rates may indicate differences in species identification. Yellowfin catch rates were below their recent levels but above the long-term average.

Appendix 3A: Special Report

The 1994 Decline of Swordfish Catch in the Hawaii Fishery

A Summary of Ongoing Analyses at the
NMFS SWFSC Honolulu Laboratory, March 1996

Introduction

After increasing rapidly from 1990-1993 the swordfish catch by the Hawaii-based longline fishery dropped almost 50% in 1994 (from 13,100,000 lbs in 1993 to 7,000,000 lb in 1994) and declined a bit further (to 5,900,000 lb) in 1995. The "boom and bust" appearance of the swordfish catch trend was enough to prompt some concern over the resource. In the 1994 Annual Report the Pelagic Plan Team and the Council called for a special report on swordfish catch and catch-per-unit-effort (CPUE) to be included in the next annual report. Causes for the 1994 decline in catch were explored through a discussion of various ongoing analyses being conducted by researchers at the Honolulu Laboratory in March 1996 (Appendix). This special report contains a summary of that discussion, and was presented to the Pelagic Plan Team, the SSC, and the Council in March-April 1996. Aside from the basic catch statistics and nominal CPUE data, all of the results presented here are preliminary and do not represent a NMFS position on these issues.

Trends in Hawaii longline CPUE may reflect a combination of factors that affect the rate at which fish are hooked: 1) the actual abundance of the population, 2) the portion of the population that is available (i.e. within range) for Hawaii-based vessels, and 3) the catchability, or fraction of the available fish that is caught by a unit of gear. Availability is affected by fish movements and fishermens' decisions about where to fish. Catchability may be influenced by gear configuration and style of operation (i.e. fishing shallow at night for swordfish versus fishing deep in the day for tuna). Segregating the data by types of fishing effort (i.e. by trip type or set type) is one method of accounting for differences in catchability. Availability and catchability are also affected by differences in when (time of day, season), where (geographic location, depth), and how intensely fish are aggregated. Including time and location as independent variables in analyses of CPUE can help to account for these effects. Environmental factors can influence abundance, availability, and catchability. Including environmental factors as independent variables in analyses of CPUE can indicate whether or not observed trends appear to be caused partially by environmental factors. The ability of different vessels to find and catch fish (sometimes called fishing power) may also affect CPUE. Comparing CPUE between different groups of fishermen is a method of looking for differences in fishing power that may bias CPUE trends as participation changes.

All of the above factors were considered in the various analyses discussed in this report. However, it is unlikely that all of the important factors have been included. Moreover, the data used here cover only a few years of a relatively new fishery. Given the large number of factors and short time series of data it would be wrong to draw strong inferences from the preliminary

analyses presented here. These results are presented to illustrate the best available estimates of current trends and to suggest which factors appear to be influencing those trends.

Trends in fishing effort

Longline fishing effort (measured in hooks) for all types of operations changed little from 1991-95 (Table 1). The geographic range of the Hawaii-based longline fishery expanded from 1991-93 reaching farthest northward and westward in 1993 (Curran et al. 1996). Data on swordfish sets from all types of trips (obtained from cluster analysis, He et al. 1996) provided the best combined measure of effort directed at swordfish. The total number of hooks in all swordfish sets (Table 1) remained about the same in 1991-93 (ca. 5.5 million hooks), declined about 20% in 1994, and declined again in 1995 (preliminary estimates suggest by about 30%). Thus the decline in swordfish catch in 1994 was too great to be explained solely by the decrease in swordfish-directed fishing effort.

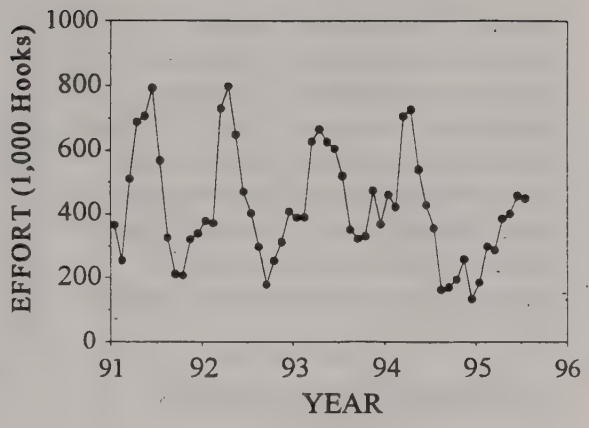


Figure 1. Monthly swordfish effort based on swordfish sets.

Table 1. Hawaii-based longline effort (hooks) from 1991-1995 for all trips, trips directed at swordfish as defined in the NMFS logbooks (Ito 1995), and swordfish sets estimated by cluster analysis (He et al. 1996). Also shown is CPUE (number of fish per 1,000 hooks) for swordfish trips, Data for 1995 are preliminary (P).

Year	Effort (all trips)	Effort (swordfish trips)	Effort (swordfish sets)	CPUE (swordfish trips)
1991	12,325,786	2,376,123	5,286,773	15.37
1992	11,717,246	2,811,710	5,241,702	14.76
1993	13,026,332	3,954,966	5,658,259	13.18
1994	11,996,072	3,506,653	4,549,135	10.34
1995P	13,324,791	1,229,426	3,600,000	15.04

On a seasonal basis, fishing effort directed at swordfish was greatest in the first two calendar quarters (Fig. 1), especially in March and April when sets were concentrated at about 28°-32° N where sea surface temperatures were around 18°-22° C. In the third quarter effort was generally

low (Fig. 1) but reached its most northward extent (Fig. 2, Curran et al. 1996) with sets made in sea surface temperatures as cold as 13°-16° C. There were fewer longline sets made in these cold northern waters in the 3rd quarter of 1994. Fishing effort for swordfish was generally low in the 4th quarter but reached an all-time low in the 4th quarter of 1994 (Fig. 1).

CPUE differentiation and trends

The CPUE data for a given type of longline fishing (i.e. swordfish trips or swordfish sets) was assumed to represent some combination of abundance, availability, and catchability and is referred to as "apparent relative abundance" or "apparent abundance". Undifferentiated, fleetwide longline CPUE data is strongly affected by changes in fishing operations to target different species. A first step in evaluating CPUE was to differentiate between types of fishing effort. Trends in apparent abundance were indexed using CPUE data (number of fish per 1,000 hooks) for swordfish trips as defined in the NMFS logbooks (Ito 1995). However, trips may cover a wide area and include different types of effort. To achieve a higher resolution of data, CPUE indices were also derived at the set level by clustering sets into groups (e.g. swordfish sets) based on the similarity of their catch composition (i.e. species mix, He et al. 1996). At the set level, catch, effort, and CPUE were described geographically and in relation to sea surface temperature and other environmental features.

A distinct decline (20%) in the annual CPUE for swordfish trips occurred in 1994

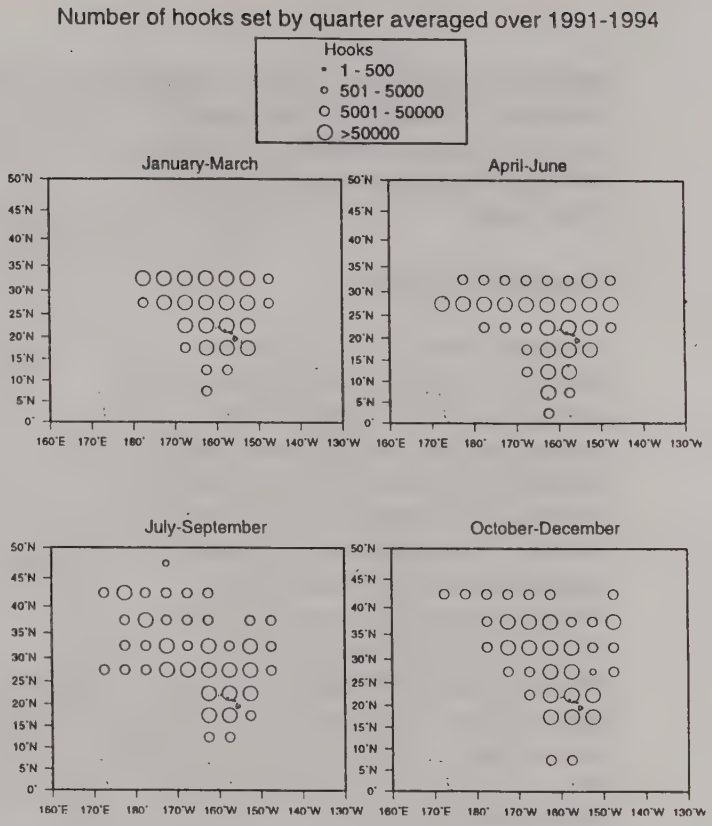


Figure 2. Number of hooks set by the longline fishery by quarter averaged over 1991 to 1994. Data are aggregated into five-degree squares.

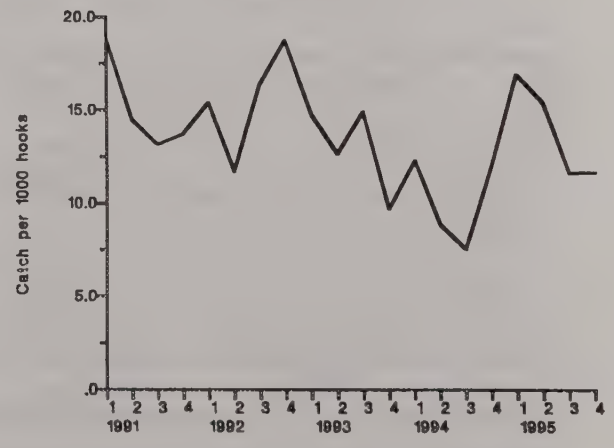


Figure 3. Quarterly swordfish CPUE estimates for swordfish trips.

but CPUE returned to normal by 1995 (Table 1). On a quarterly basis the trend in CPUE for longline trips (as defined by logbooks) showed a peak in the start of 1991 followed by a decline and then a rise to another peak at the end of 1992 (Fig. 3).

CPUE declined in 1993 and through to the 3rd quarter of 1994 when it reached its record low level. At the end of 1994 and start of 1995 CPUE rose back to average levels and then declined slightly in the remainder of 1995. Calculating CPUE from swordfish sets (as defined by cluster analysis) produced a very similar view of the trend in CPUE (fig. 4). The decline in swordfish CPUE in 1994 combined with the decline in effort in that year accounts for the decline in catch in 1994.

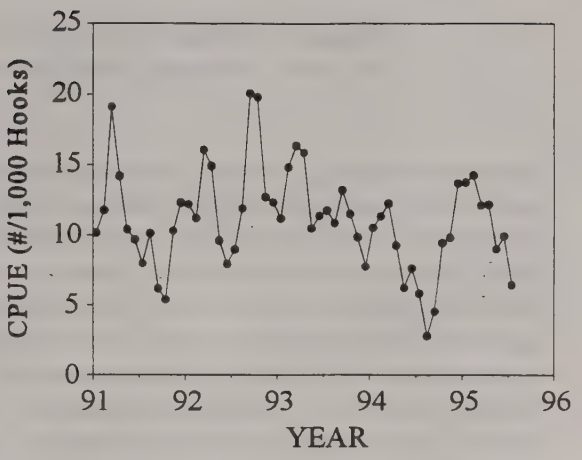


Figure 4. Monthly swordfish CPUE based on swordfish sets.

The early 1991 peak in CPUE (March 1991, Fig, 4) occurred mostly in the 28°-32° N fishing area and was not matched by an equivalent CPUE on that fishing area in subsequent years. The late 1992 peak in CPUE (September-October 1992, Fig. 4) was largely due to increased fishing in the cold-water fishing area between 40°-45° N and again this CPUE level was not attained on that fishing area in subsequent years.

Discussion of hypotheses to explain the 1994 catch decline

Combined with a decrease in fishing effort directed at swordfish there could have been:

1. A decline in abundance as a result of fishing pressure, or as a result of environmental effects on recruitment and mortality. This hypothesis is that there was a real decline in the overall number of swordfish in the North Pacific, due either to the Hawaii fishery, or other fisheries, or due to changes in recruitment and other ecosystem dynamics.

2. A decline in availability or catchability as a result of changes in the environment. This hypothesis is that the conditions under which Hawaii fishermen catch swordfish changed such that the fish are less available (e.g., didn't migrate to the fishery), or less catchable (more dispersed, deeper, etc.)

3. A decline in average fishing power as a function of the entry and exit of participants and changes in operations. This hypothesis is that in addition to the fishery directing less effort at swordfish, the individual vessels targeting swordfish

became less efficient than they were earlier, and/or that some aspect of the dynamics of this part of the fleet reduced overall cooperation in finding swordfish.

By some measures (i.e. annual CPUE for swordfish trips) the apparent relative abundance of swordfish declined virtually from the start of proper monitoring in 1991 (Table 1). By other measures (i.e. monthly CPUE for swordfish sets, Fig, 4) relative abundance appeared to decline in each of two major fishing areas soon after they were first exploited. Apparent relative abundance on the closest fishing area (i.e. the spring fishing areas at 28°-32°) declined after 1991 and apparent relative abundance on the farther fishing area (i.e. the autumn fishing area at 40°-45°) declined after 1992. One could hypothesize that this represented classic "fishing down" of a stock or stocks under a new, higher level of exploitation. However, this version of the first hypothesis (above) doesn't explain how the abundance of the fish could rebound so quickly by 1995 (Figs. 3 and 4). Abundance tends to recover gradually in long-lived species such as swordfish.

It could be that the reduction in effort which began at the end of 1994 removed some competition among fishermen. According to this hypothesis, fishermen physically interfered with each others' operations during 1991-94 when effort was high, and/or they removed a large proportion of the fish seasonally present in the most productive fishing areas. The hypothesis is that the decline in CPUE in 1993-1994 might still have reflected a decline in true abundance but the rapid rebound of CPUE by 1995 did not reflect an increase in true abundance. Rather, the hypothesis is that the fishermen hampered each other in harvesting a highly localized fraction of a decreasing resource until the number of fishermen declined in late 1994 and 1995. According to this hypothesis if CPUE recovered in 1995 due to reduced competition then CPUE would be expected to decline quickly to 1994 levels if fishing effort (i.e. competition) were to increase to its former (1991-93) level.

A reason to doubt that there was a decline in the true abundance of the swordfish resource is the absence of any negative

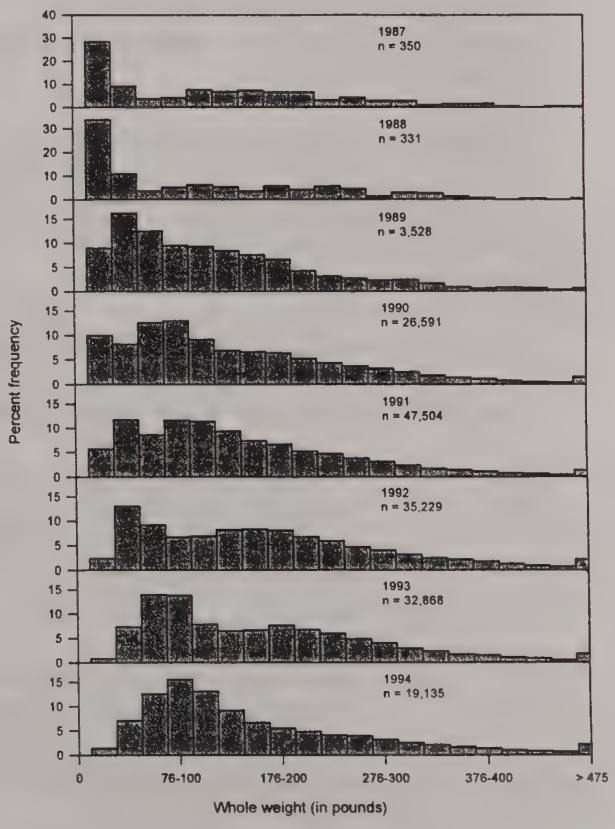


Figure 5. Swordfish weight-frequency histograms (1987-1994).

impacts on the size (weight) frequency distribution of swordfish (Fig. 5). Weight data prior to 1990 was not representative of a swordfish directed fishery. The decreasing frequency of small swordfish from 1990-1994 was probably due the fishermen learning to target larger fish (DiNardo and Kwok 1996). More important was the relative stability of the weight frequency distribution of fish above 100 lbs from 1990-1994. A mode of larger fish (150-200 lb) was evident in 1992-1993 but not in 1991 or 1994. This may have been due to a relatively low level of fishing effort in the northern fishing area in those years. There is evidence that larger fish are caught by the fishermen that exploit the northern area (DiNardo and Kwok, 1996).

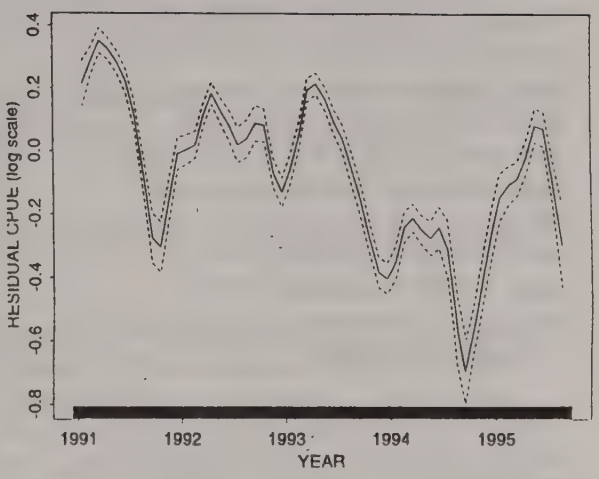


Figure 6. Time-series of residual swordfish CPUE (log scale) based on all fishery participants.

Regarding the second hypothesis concerning the 1994 decline, several analyses are underway to try and quantify environmental effects on fishery performance. Generalized additive models (GAMs) have been used to quantify nonlinear relationships between CPUE and various factors, and to show the remaining (i.e. residual) trend in CPUE after these factors have been accounted for. Factors such as moon phase, SST, the intensity of SST fronts, lagged effects of SST fronts, time of year, and the area fished were all found to have statistically significant effects on CPUE. After the effects of temperature factors, time, and area are accounted for and removed from the CPUE trend, the residual trend in CPUE, and its 95% confidence limits clearly indicate that statistically significant declines in swordfish CPUE occurred in 1991 and in 1993-1994 with a rebound at the end of 1994 that returned CPUE to an average level in 1995 (Fig. 6).

Although analysis of sea-surface temperature patterns has statistically accounted for much of the variability in swordfish CPUE it has not, as yet, explained the decline in 1993-1994 or the recovery in 1994-1995. It is very likely that the relevant environmental factors have not yet been properly defined in the GAM analysis. For example, there is strong evidence that the convergence of water masses was less intense in 1994 than in the previous years. Models of the wind-driven circulation in the North Pacific indicate that a southward flow of water (negative V, Fig. 7) is interrupted at about 30° N creating a convergence in the middle of the primary fishing area. This southward flow was much weaker in the first quarter of 1994 than in the first quarter of the preceding years. Convergent fronts are thought to play an important role in aggregating swordfish.

The lower level of production per unit of effort that began in 1993 may have motivated some of the decline in effort directed at swordfish that began in 1994. Some fishermen had other reasons to leave the fishery, including opportunities elsewhere and requirements to maintain licenses through participation in other fisheries. Much less fishing was conducted in the northernmost fishing areas in 1994, due perhaps to the departure of those operators most capable of distant-water fishing.

The hypothesis that fishing effort directed at swordfish in 1994 was less efficient (i.e. fishing power was reduced) due the departure or target-switching of the best operators in 1994 (hypothesis 3) was examined through an analysis of CPUE for two categories of participants: 1) those that fished for swordfish regularly throughout 1991-95 and 2) those that fished regularly only throughout 1991-93 and departed or quit targeting swordfish in 1994 (Fig. 8). The results indicated that those who quit in 1994 had started with the highest CPUE but experienced declines in CPUE throughout their participation, especially from 1993-94. Those who participated throughout increased their CPUE from 1992-93 but then also experienced declining CPUE from 1993-94. Since both groups experienced the 1993-94 decline, which preceded the decline in effort, it seems unlikely that a decrease in efficiency or cooperation among participants was the cause for the 1993-94 decline in CPUE.

In conclusion, we cannot reject the possibility that the abundance of swordfish has been reduced, perhaps by

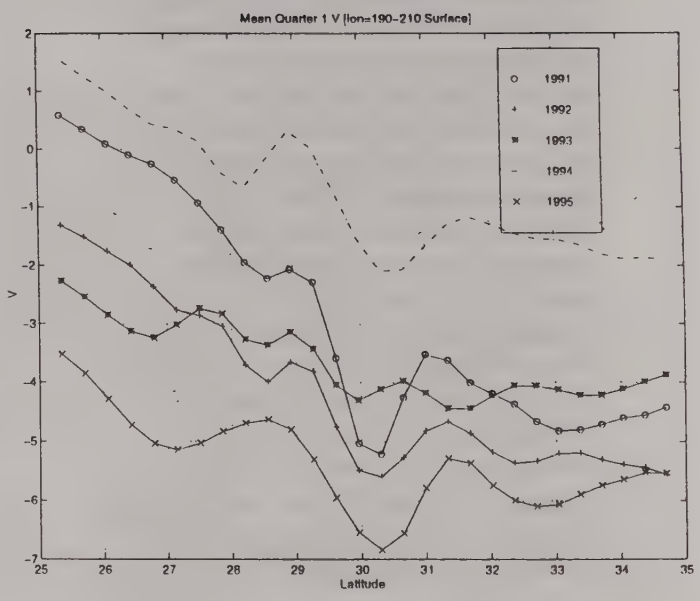


Figure 7. First quarter estimates of water flow (V) by year. Negative values on the vertical axis indicate southward flow.

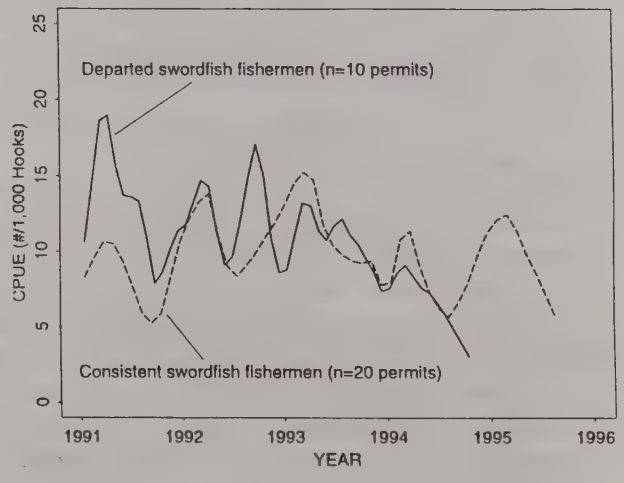


Figure 8. Swordfish CPUE time-series for various participants.

the increased fishing mortality caused by the Hawaii-based fishery. However some rather complex and unusual competitive dynamics must be postulated in order to explain the rapid recovery of CPUE by 1995. It seems unlikely that the decline in CPUE was an effect of the departure of some participants, although reduced effort definitely accounts for the sustained (i.e. through 1995) decline in catch.
Although it has yet to be properly quantified in an analytical sense, the most likely explanation for the CPUE decline in 1994 appears to be a change in the environment which affected the availability and or the catchability of swordfish.

In its review of this report, the SSC concurred with the conclusions of the preceding paragraph, and added:

> The directed swordfish fishery has a short history and the time series of the key variables, such as catch and catch rate, shows much "noise". This is not unusual for a new fishery, and it is hard to predict with confidence whether a firm trend has begun. The time series of size-frequency data is reassuring: it does not suggest that fishing pressure to date has resulted in a reduction in fish size. The time scale of changes in the other variables (e.g. CPUE), including the rapid upturn in 1995, suggests that the effects of fishing have not been separated from the "noise" created by other (unknown) factors such as the dynamics in spatial distribution of the fish versus the fishermen or environmental variability that affects catchability. **NMFS staff should continue to analyze the data closely for any identifiable trends.**

As a result of this recommendation more detailed time series of longline CPUE are now included in the regular NMFS longline fishery reports. The NMFS Honolulu laboratory places a high priority on swordfish research.

Citations

Ito, R. Y., 1995. Annual report of the 1994 Hawaii-based longline fishery. Honolulu Lab., Southwest Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396. Southwest Fish. Sci. Cent. Admin. Rep. H-95-08.

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Appendix

Participants in the March 1996 discussion of ongoing analyses being conducted by researchers at the Honolulu Laboratory (in alphabetical order).

Keith Bigelow
Chris Boggs
Rita Curtis
Gerard DiNardo
Marcia Hamilton
Xi He
Russell Ito
Kurt Kawamoto
Don Kobayashi
Walter Machado
Jeff Polovina
Sam Pooley
Mike Travis

Appendix 3B

Bycatch and Discards of Blue Shark, *Prionace glauca*, by the Hawaii-based Longline Fishery from 1991 to 1995

Xi He
Joint Institute of Marine and Atmospheric Research
School of Ocean and Earth Sciences and Technology
University of Hawaii
and
Christofer H. Boggs
Honolulu Laboratory, Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA

Abstract[1]

1. Total bycatch and total discards of blue shark, *Prionace glauca*, by the Hawaii-based longline fishery from January 1991 to August 1995 were estimated using both logbook and observer data. A total of 505,116 blue shark were caught and over 99% of these were discarded. This estimated total was only 7.9% higher than the total number of blue shark reported in logbooks.

2. The highest catch rates of blue shark were found in one subgroup of longline sets which targeted swordfish, *Xiphias gladius*. These rates occurred in the transition zone between 35°N and 45°N latitude during September and October.

3. Another subgroup of the longline sets which targeted swordfish, however, had very low blue shark catch rates. The spatial distributions of fishing effort, time of fishing, number of hooks used per set, and duration of sets were very similar between these two subgroups. But the subgroup that had low catch rates of blue shark used fewer lightsticks than did the subgroup that had high catch rates of blue shark.

4. The blue shark mortality caused by longline fishing, including fish that were kept, finned, and those known to be dead before discard, was estimated from observer data to be 38.6%. Additional mortality is possible since 13.4% of the total blue shark catch were discarded in unknown condition and some fish discarded alive may have later died due to stress and wounds.

5. As reported in logbooks, proportions of blue shark that were caught, finned, and then discarded (finning rates) increased steadily from 0.0 in 1991 to about 0.3 in 1995, with an average finning rate of 0.095 over the whole period.

6. Cluster analysis was used to categorize all longline sets into subgroups based on catch composition, ratio estimators were used to extrapolate observer data to the entire fleet, and under-reporting rates were used to raise logbook data for periods without observer data.

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[1]This report is under review, and will be issued soon as a NOAA NMFS SWFSC Technical Memorandum.

7. Future work will concentrate on the bycatch of blue shark as related to further aspects of fishing operations, finer spatial and temporal scales, and simulation models to evaluate fisheries impacts on the blue shark population. Additional observer data and data on blue shark catches by other countries will be needed to accomplish the latter task.

Appendix 3C

Bluefin Tuna Report

Bluefin tuna catch by the Hawaii longline fishery was negligible prior to 1993. Japanese longline records summarized by 5°x5° for 1972-76 (Bayliff 1993) indicate the greatest catches of bluefin tuna in the Pacific by Japan occurred between 30°-40° N especially to the west of 175° E. The advent of the Hawaii-based U.S. swordfish fishery in the 1990s and the northward and westward expansion of fishing range, especially in 1993 (Curran et al. 1996), probably led to the first substantial Hawaii-based catches in that year. However, the Hawaii-based bluefin tuna catch was not really monitored prior to 1993. Monitoring methods were changed several times from 1993-1995.

The inconsistency of monitoring methods makes any evaluation of Hawaii-based bluefin tuna catch trends somewhat speculative. The catch for 1993 was estimated at 200,000 lbs (Dollar 1994) based on a raised tally of pounds landed at wholesale markets in Honolulu during 2 days sampled per week out of 6 market days per week. Bluefin tuna was not listed on the logbook form until 1995 but in 1994 fishermen were encouraged by NMFS staff to "write in" their bluefin catch separate from "the other tuna" category listed on the logbook. In 1994 the landings of bluefin were estimated as the number of bluefin tuna written-in on logbooks multiplied by the average weight of bluefin tuna from the market data. Using this method, the 1994 estimate was only 30,000 lbs (Ito 1996), an 85% decline. Perhaps the new method of estimation was partially the cause for this apparent decline; however, fishing effort in the far North and West by the Hawaii-based fishery was reduced in 1994.

In 1995 logbooks were re-written to specify northern bluefin tuna as a printed category of catch. The new logbooks had largely replaced the old by the end of the first quarter of 1995 (Ito 1996). Based on logbooks, the numbers of bluefin tuna caught by the Hawaii-based fishery in 1994 and 1995 were 168 and 218 fish, respectively. This suggests a 30% increase in catch but the difference may be largely due to the clearer reporting requirement provided by the revised logbooks.

The magnitude of the Hawaii-based fishery's catch is insubstantial compared to total catches by Japan, Korea, and Taiwan of 6,000 - 17,000 tons per year in the western Pacific during 1990-92 (Bayliff 1993). However, only a few percent of the northern bluefin tuna catch by Japan is caught by longline, so the total western Pacific catch of large (i.e. >200 lb) fish like those landed by the Hawaii-based longline fishery may be only about 500 tons per year. The Hawaii-based fishery, at 10-100 tons/year, might contribute substantially to fishing mortality for the larger fish, especially in the central Pacific.

Some reports have suggested that targeting on bluefin tuna by the Hawaii-based longline fishery might increase or that a directed fishery targeting this species might develop. The latter seems unlikely given the very low catch rates. At most bluefin tuna may become one of a suite of target

species that provides an occasional bonanza in revenue. Prices received for bluefin tuna by Hawaii-based longliners averaged about $14.00/lb in 1993-94, over 3 times higher than the next-highest priced species, bigeye tuna.

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Appendix 4

Commonwealth of the Northern Mariana Islands

Introduction

The Northern Mariana Islands pelagic fishery occurs primarily around the islands of Saipan, Tinian, Rota and Aguijan. The fishery is characterized using data in the Commercial Purchase Data Base. The collection system for the data is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Staff from the Department of Lands and Natural Resources, Division of Fish and Wildlife (DFW) routinely distribute and collect invoice books from 69 participating local fish purchasers on Saipan. Purchasers include practically all fish markets, stores, restaurants, hotels and roadside vendors ("fish-mobiles"). Data collection commenced on Rota during March 1993 and on Tinian during August 1993, making 1995 the third year that Tinian and Rota were included in the Commercial Purchase data collection system. This data set includes fourteen participating vendors on Rota and five on Tinian. Existing software programs are still in need of revision for data entry and analysis functions.

Although the Saipan data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be used. Data quality, with respect to accuracy of landings and species identification on the invoice, needs to be investigated and verified; conclusions reached in this report should be considered provisional. Fortunately, the most complete data were obtained from the larger operations, so general landings trends, while underestimated, are believed to be relatively accurate.

This database lacks information concerning fishing method, location and effort, although the Boat-Based Creel Survey could provide the additional data required for further analysis. Estimates of total landings and effort by method are yet to be generated.

To fish commercially within the NMI's exclusive economic zone (EEZ), commercial vessels over five net tons must have a Commercial Fishing License, issued annually and jointly by the Department of Commerce & Labor and the Department of Natural Resources. Depending on the information supplied in the application package, the DFW may impose certain fishing restrictions in the form of license conditions. Although commercial boats under five net tons aren't required to have a license to fish, all fishing boats are registered with the Department of Public Safety(DPS). Information below in parenthesis pertains to data provided by DPS for 1994's report, as they have not yet been able to provide DFW with similar data for 1995.

Summary

Trolling is the primary fishing method utilized in the pelagic fishery. The pelagic fishing fleet, other than charterboats, consists primarily of vessels less than 24 ft in length which usually have a

limited 20-mile travel radius from Saipan. In 1995, about 78% of all registered boats participated in some form of fishing activity. There were 87 vessels identified as being involved full-time in commercial fishing, whereas 69 vessels were classified as part-time. Subsistence fishing and/or recreational usage included 301 vessels (for all kinds of fish). Pelagic fishing trips are generally restricted to daylight hours.

In 1995, 33 vessels were registered with the Boating Safety Office as charter vessels, although only 8 vessels conduct full-time charter fishing operations. The remaining 25 charter vessels are associated with part-time fishing and the tourist transport industry. Each charter vessel generally retains its catch and sells at least half to local markets. The magnitude of charterboat sales are unknown, but at this time it is questionable whether the local market can absorb the catch without impacting commercial fishermen. The logbook system used in 1993 was not used in 1995.

The primary target species for the pelagic fleet remain skipjack tuna and mahimahi. During their seasonal runs, these fish usually inundate nearshore waters and provide easy targets for the local fishermen. In addition to the economic advantage of being nearshore and their relative ease of capture, these two species are widely accepted by all ethnic groups. This has kept market demand fairly high due to the continuing immigrant population growth on Saipan (about half of the population on Saipan is non-native).

The use of larger vessels (>50 ft) for pelagic fishing remains limited. Four commercial fishing licenses were issued in 1995, four in 1994, two each in 1993 and 1992, and none in 1991. In 1995 one licensed vessel fished the full 12 months. These four vessels landed pelagics incidentally.

Recommendations

1) An examination to determine dynamics of participation of commercial fishermen should be completed for at least the past four years to determine the industry's participation thresholds (see Fig. 4).

2) A careful review and comparison of length frequencies and regional landings should be conducted to obtain general biological characteristics from the fishery.

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Table 1. NMI 1995 commercial pelagic landings, revenues and price

Species	Landings (lb)	Revenue ($)	Ave. Price ($/lb)
Misc. tunas	369	720	1.95
Skipjack tuna	105,389	186,205	1.77
Yellowfin tuna	16,128	32,119	1.99
Subtotal Above Tunas	**121,886**	**219,044**	**1.80**
Dogtooth tuna	6,035	12,498	2.07
Mahimahi	18,576	32,427	1.75
Marlin	5,295	8,219	1.55
Sailfish	78	149	1.91
Wahoo	4,555	9,366	2.06
Subtotal Other PPMUS	**34,539**	**62,659**	**1.81**
Troll fish	2,365	4,456	1.88
Barracuda	153	295	1.93
Rainbow runner	544	1,093	2.01
Subtotal Misc.	**3,062**	**5,844**	**1.91**
All Pelagics	**159,487**	**287,547**	**1.81**

Source and Calculation

Annual summaries for each species from the Commercial Purchase Data Base invoices.

Interpretation

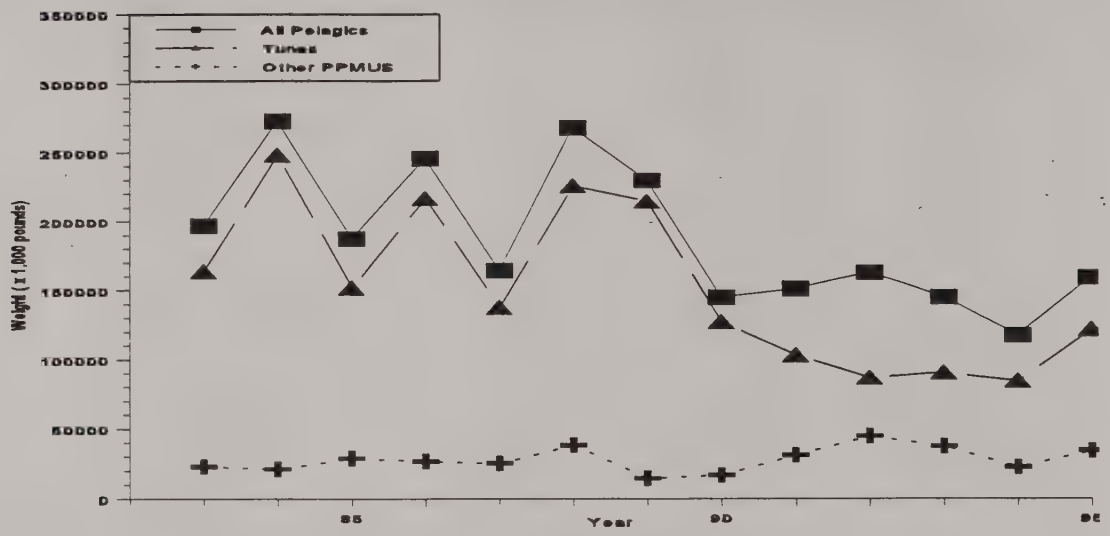
Skipjack catch increased by over 30,000 pounds in 1995, comprising about two thirds of the (commercially receipted) industry's pelagic catch. Mahimahi and yellowfin tuna were still ranked second and third in total landings during 1995, increasing to 11% and 10% of the total catch, respectively. Schools of mahimahi, like skipjack tuna, are easily caught in nearshore waters. Mahimahi are highly seasonal with peak catch rates usually from February through April. Overall pelagic catch increased nearly 42,000 pounds in 1995.

The highest average price of identified pelagic species was $2.07/lb for dogtooth tuna, which is down from the 1994 high of $2.10/lb. The lowest priced species remained marlin at $1.55/lb. The market share of total pelagic revenues by combined yellowfin tuna and mahimahi decreased from 37% in 1994, to 22% in 1995. Skipjack revenue remained at about 65% of total revenues. Dogtooth, wahoo, and rainbow runner all surpassed yellowfin tuna in average price in 1995. Skipjack tuna, the species with the greatest landings, received only $1.77/lb on average yet it was still responsible for close to two thirds of the total pelagic revenues for 1995.

Blue marlin, which again brought the lowest average price in 1995, is taken primarily by charterboat fishers. The catch of blue marlin increased from 2,100 pounds in 1994 to 5,295 pounds in 1995. Other recreational fishers also take it during scheduled fishing tournaments. Although not generally regarded as a high quality food fish, marlin sashimi is sold in local restaurants and hotels. It is also being served in public institutions. The low ex-vessel price could be partly related to the manner which the fish is kept prior to sale and the bulky size. These fish are generally not iced when caught and, therefore, are usually of lower quality at the time of sale.

Fishers usually wish to sell the whole fish to avoid cleaning and repackaging the fish into smaller units for sale to restaurants.

Figure 1. NMI annual commercial landings: all pelagics, tuna and PPMUS.



	Total Landings (lb)		
Year	**All Pelagics**	**Tunas**	**Other PPMUS**
1983	196,788	163,754	23,081
1984	272,909	248,339	21,223
1985	187,378	151,882	29,105
1986	245,967	217,023	26,800
1987	164,055	137,566	25,467
1988	267,619	225,498	38,368
1989	229,427	214,249	14,650
1983	144,862	127,172	16,893
1991	150,915	103,078	31,300
1992	162,691	86,931	45,061
1993	145,115	90,584	37,628
1994	117,668	84598	22701
1995	**159,486**	**121,885**	**34,539**
Average	188,068	151,735	28,217
Standard Deviation	50,622	57,444	8,912

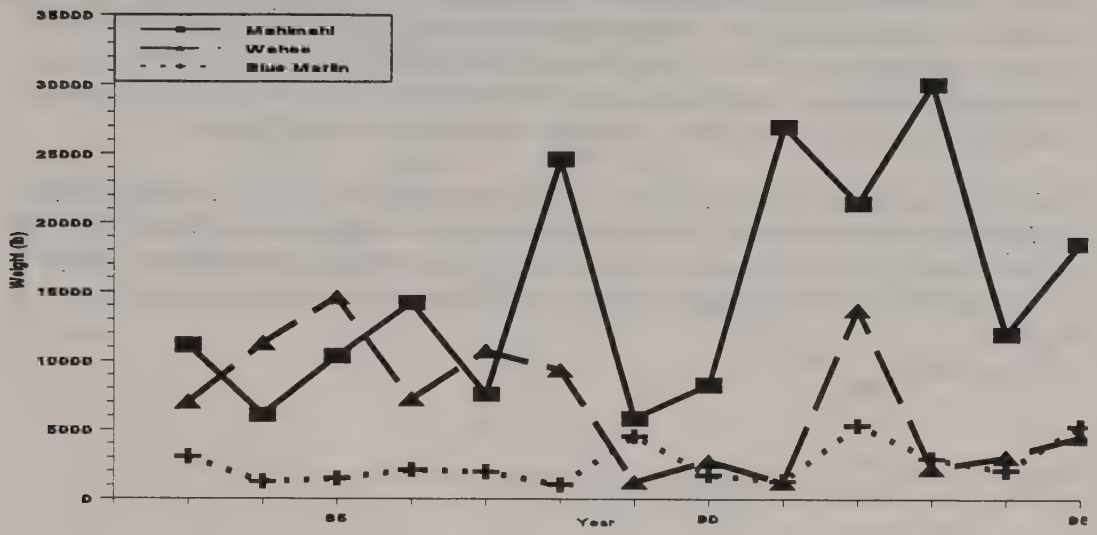
Source and Calculation

All pelagics, tuna and other PPMUS landings were summed from the Commercial Purchase Data Base.

Interpretation

Total weight of pelagics landed in 1995 approached 1992 levels. Recorded landings of tunas incresed nearly 38,000 pounds to 121,885 pounds in 1995. Although this was a sharp increase compared to the previous four year average of 91,298 pounds,, it stll falls well short of the 1983 - 1990 average of 185,685 pounds. Catch in the 'Other PPMUS' category incresed to 1993 levels.

Figure 2. NMI annual commercial landings: mahimahi, wahoo, and marlin.



	Total Commercial Landings (lb)		
Year	Mahimahi	Wahoo	Blue Marlin
1983	11,151	7,008	3,030
1984	6,091	11,270	1,235
1983	10,364	14,601	1,488
1986	14,237	7,250	2,123
1987	7,602	10,723	1,968
1988	24,639	9,358	1,047
1989	5,856	1,257	4,563
1990	8,306	2,770	1,748
1991	27,005	1,217	1,320
1992	21,462	13,738	5,345
1993	30,036	2,257	2,950
1994	11,993	3,090	2,108
1995	**18,576**	**4,555**	**5,295**
Average	15,178	6,853	2,632
Standard Deviation	8,295	4,732	1,519

Source and Calculation

The annual commercial landings of the three major PPMUS species (mahimahi, wahoo and blue marlin) were summed directly from the Commercial Purchase Data Base.

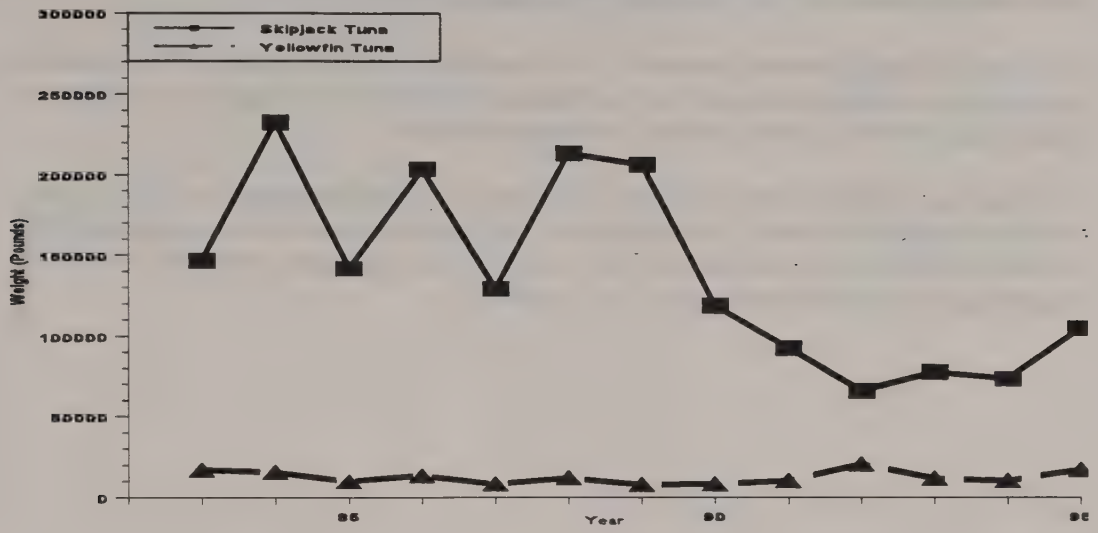
Interpretation

Mahimahi landings incresed 35% in 1995, though were still lower than the 1991 -1993 average of 26,168 pounds. It is noteworthy that NMI and Guam mahimahi catch have fluctuated similarly since about 1987, which may indicate a strong biological influence in local landings patterns.

From 1983 to 1988, wahoo landings were somewhat consistent and did not fall below 7,000 lb, but in 1989 landings notably declined by 86% and remained at depressed levels until the dramatic increase in landings during 1992. Following the near-record 1992 landings, the 1993 wahoo landings again decreased by 84%, falling below the mean. Wahoo landings in 1995 increased 47% over 1994 landings. A partial explanation for this increase may be due to wahoo being caught incidently in Northern Islands' deepwater shrimp and reef fish fisheries.

The 5,295 pound in blue marlin landing is second only to the 1992 catch level. This is a 151% increase over last years landing. It is interesting to note that the time series in the above table indicates marlin 'peak' landings every three years, with the 1986 'peak' showing the smallest increase at 42% over the previous year with the 1989 'peak' showing the highest increase at 335%.

Figure 3. NMI annual commercial landings: skipjack and yellowfin tuna.



	Total Commercial Landings (lb)	
Year	**Skipjack tuna**	**Yellowfin tuna**
1983	146,729	17,025
1984	232,675	15,664
1985	141,910	9,973
1986	203,490	13,533
1987	129,203	8,363
1988	213,198	12,300
1989	206,162	8,087
1990	118,798	8,374
1991	92,642	10,433
1992	65,982	20,672
1993	77,832	11,919
1994	73,769	10,600
1995	**105,389**	**16,128**
Average	139,060	12,544
Standard Deviation	57,828	3,870

Source and Calculation

Landings were summed directly from the Commercial Purchase Data Base.

Interpretation

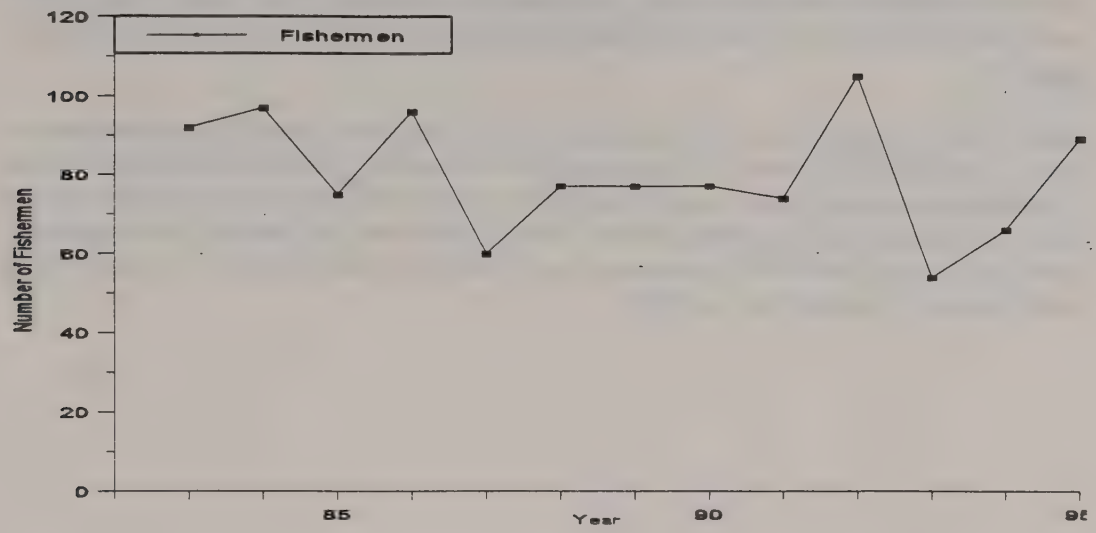
Historically, skipjack landings exhibited an alternating two-year cycle from 1983 to 1988 and comprised over 73% by weight of the total pelagic landings each year from 1983 to 1989 (data taken from Table 1 and Fig. 3). Skipjack tuna landings declined after that, setting record lows in 1990, 1991 and 1992. In 1993 and 1994 skipjack landings showed signs of stabilizing at about

half of their respective eleven and twelve year means, while the nearly 32,000 pound increase in 1995 landings attained 61% of the 1983-1990 average of 174,020 pounds.

Schools of skipjack tuna have historically been ubiquitous in nearshore waters, thus providing an opportunity to catch numerous fish with a minimum of travel time and fuel costs. Skipjack are readily consumed by the local populace, primarily as sashimi.

Although more highly prized than skipjack, in Saipan waters yellowfin tuna aren't as common, and therefore not often taken. The average fish size tends to be smaller when compared with yellowfin tuna from other geographic areas. The 1995 landings increased by 52% over 1994, surpassing the 1983-1994 average of 12,246 pounds.

Figure 4. Number of NMI fishermen (boats) making commercial pelagic landings.



Year	No. fishermen landing any pelagic species
1983	92
1984	97
1985	75
1986	96
1987	60
1988	77
1989	77
1990	77
1991	74
1992	105
1993	54
1994	66
1995	**89**
Average	80
Standard Deviation	15

Source and Calculation

Each invoice from the Commercial Purchase Data Base records the fisherman's name from whom the fish were purchased. The number of fishermen who sold any pelagic species was calculated directly from the data invoices.

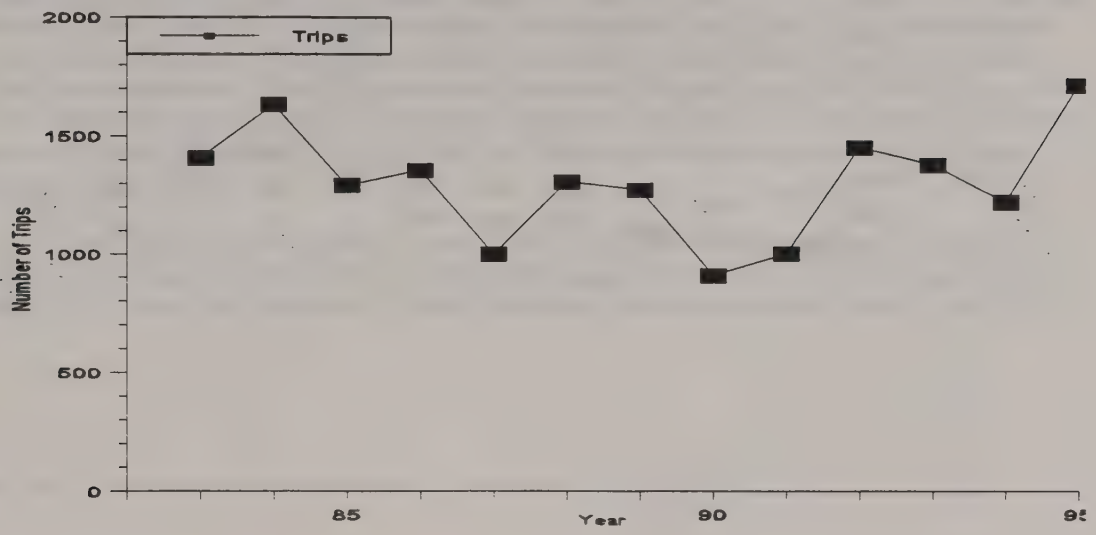
Interpretation

The number of fishers (boats) making commercial pelagic landings was relatively constant from 1988-91 compared to earlier years, but a record high number was recorded for 1992 (+42% from

1991). Some of the increase in 1992 was attributable to the influx of new fishing boats as a result of money obtained by leasing property. In addition, it was discovered that some fishers were using several different boats, thus artificially inflating the total number of boats making pelagic landings.

Many of 1992's "new" fishers, with their new boats, are believed to have left the fishery during 1993. The number of fishers in 1995 increased 35% from 1994. It has been suggested that the 1994 increase may have been due to the re-entry of repaired and refurbished boats from the 1992 fleet. It is possible that this activity has also played a role in the 1995 increase. As suggested in 1994, an entry/exit pattern of fishermen and boats within the fishery should be completed for the past five years to explore this possibility.

Figure 5. NMI number of trips catching any pelagic fish.



Year	Number trips
1983	1,408
1984	1,634
1985	1,293
1986	1,356
1987	999
1988	1,306
1989	1,272
1990	910
1991	1,002
1992	1,451
1993	1,378
1994	1,221
1995	**1,713**
Average	1,303
Standard Deviation	235

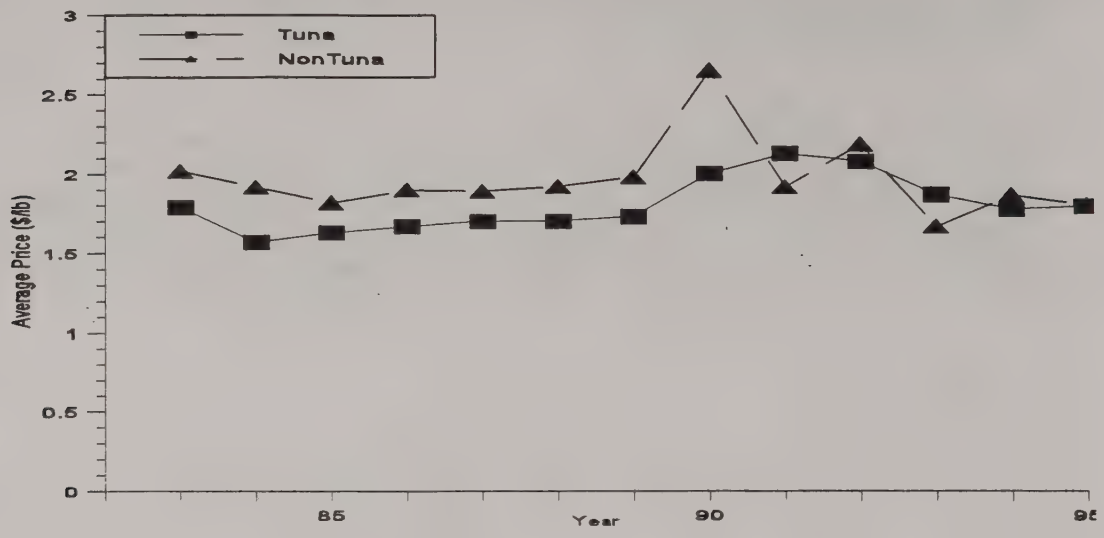
Source and Calculation

The total trips for all pelagic species were summed from the Commercial Purchase Data Base. Trips were calculated based on the assumptions that no fisherman makes more than one trip per day, and that all sales from a single trip are made on a single day.

Interpretation

The number of pelagic trips increaased to an all time high in 1995, which corresponds well with the tabled data from the previous four graphs which show an increase in landings and number of fishers. It cannot be determined whether or not this sharp increase is actual, or due to an increase in invoice supply and collection effort.

Figure 6. NMI average inflation-adjusted price of tunas and other PPMUS.



	Average Price ($/lb)			
	Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	0.99	1.79	1.12	2.02
1984	0.95	1.57	1.15	1.92
1985	1.02	1.63	1.14	1.82
1986	1.07	1.67	1.22	1.90
1987	1.14	1.70	1.27	1.89
1988	1.20	1.70	1.35	1.92
1989	1.29	1.73	1.48	1.98
1990	1.56	2.00	2.07	2.65
1991	1.80	2.13	1.92	2.26
1992	1.91	2.08	2.01	2.19
1993	1.78	1.87	1.59	1.67
1994	1.75	1.78	1.83	1.87
1995	**1.80**	**1.80**	**1.81**	**1.81**
Average	1.40	1.80	1.54	1.99
Standard Deviation	0.37	0.17	0.35	0.25

Source and Calculation

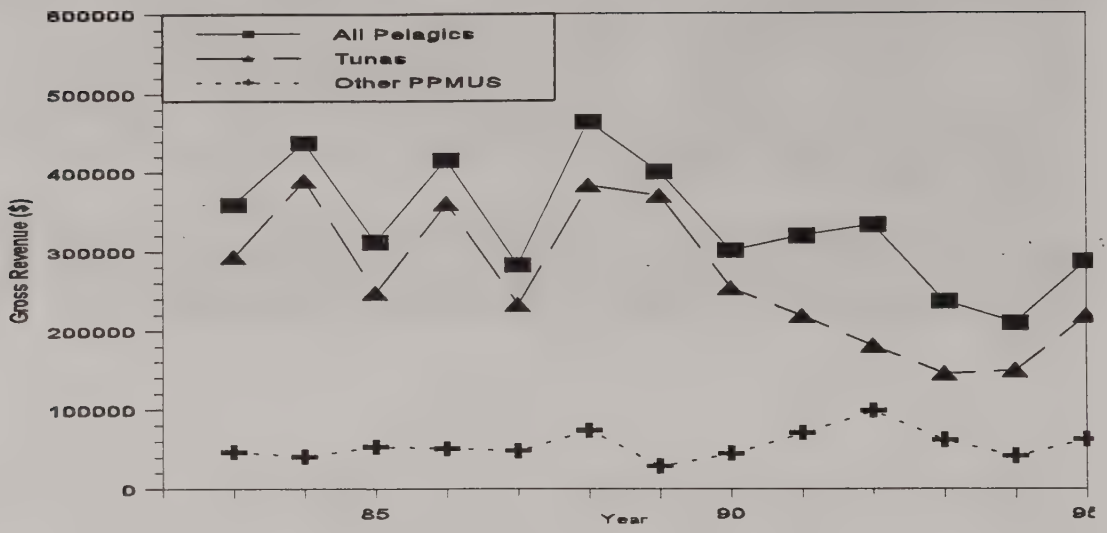
The unadjusted average price is calculated by dividing the total revenues generated by the total weight sold. The inflation adjustment is made using the 1995 NMI Consumer Price Index (CPI) as the basis by which calculations of previous years' prices are made.

Interpretation

The inflation-adjusted average price of tuna was stable from 1983 until 1989, when an obvious rise was observed. The 1990-92 rise in price corresponds with the notable decrease in skipjack tuna landings (Fig. 3) during the same period of time. In 1994 commercially receipted tunas commanded a lower price than in recent years. However, considering the inflation-adjusted prices from 1983 to 1994, it would appear that tuna prices have, on the whole, kept pace with inflation. The real decline in the last two years is likely a symptom of the effects of the NMI's recent economic downturn, as well as an increase in tuna imports.

In 1995 the normalization of the relaive value of tuna to the "Other PPMUS" category coninued. The data also suggest that fish in the "Other PPMUS" category did not kept up with inflation in 1994 and 1995. The long-term average ($1.99/lb) is lower than the inflation adjusted price in 1983.

Figure 7. NMI annual commercial adjusted revenues.



	Revenues ($)					
	All Pelagics		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	198,710	359,665	162,240	293,654	25,770	46,644
1984	264,203	438,577	235,262	390,535	24,503	40,675
1985	195,372	312,595	155,171	248,274	33,162	53,059
1986	267,013	416,540	231,745	361,522	32,631	50,904
1987	190,150	283,324	156,634	233,385	32,333	48,176
1988	327,260	464,709	270,679	384,364	51,950	73,769
1989	299,142	400,850	276,671	370,739	21,635	28,991
1990	235,520	301,466	198,775	254,432	34,968	44,759
1991	271,030	319,815	185,662	219,081	60,031	70,837
1992	305,927	333,460	166,235	181,196	90,627	98,783
1993	249,136	237,509	161,100	146,054	60,001	62,019
1994	207,124	210,201	147,940	150,389	41,548	41,822
1995	**287,546**	**287,546**	**219,044**	**219,044**	**62,659**	**62,659**
Average	253,703	335,866	197,474	265,590	43,986	55,623
Standard Deviation	45,573	76,918	44,992	87,197	19,962	18,074

Source and Calculation

Annual revenue in dollars was summed separately for all pelagic fish, tunas and other PPMUS. Inflation-adjusted revenues were calculated using the Consumer Price Index, with 1995 as a base by which previous years' nominal prices are adjusted.

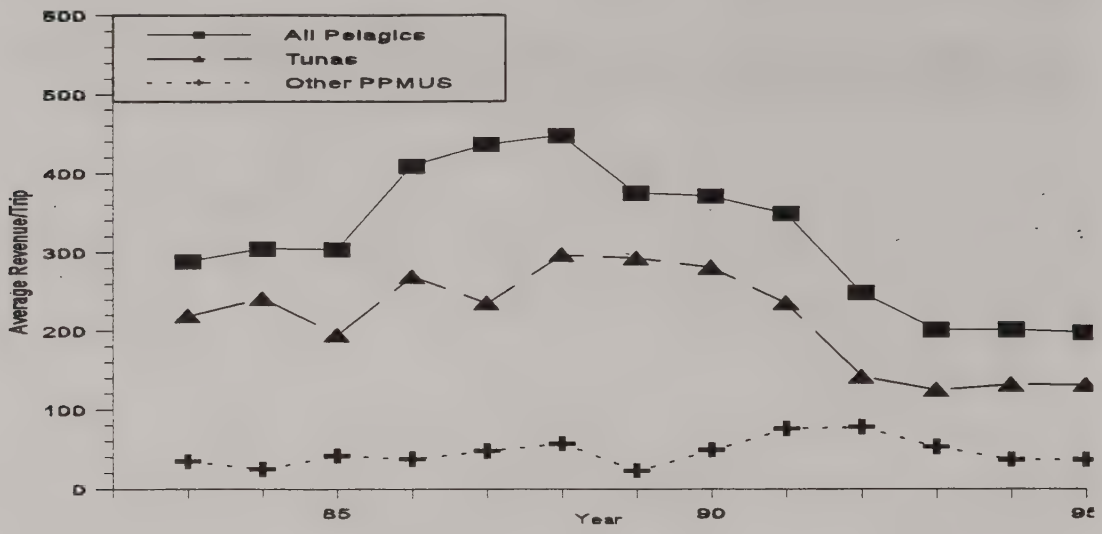
Interpretation

The erratic fluctuations of the inflation-adjusted revenues for Tunas and for All Pelagics prior to 1990 is most likely due to the annual variations in skipjack tuna landings (see Fig. 3) which completely dominate the tuna category and, therefore, the All Pelagics category. The divergence of All Pelagics

and Tunas in 1991 and 1992, which normally correspond, is corrected between 1993 and the end of 1995.

The tunas' inflation-adjusted revenues increasesd 46% in 1995, on par with the 1991 level. "Other PPMUS" inflation-adjusted revenues increased by 48% from the 1994 level.

Figure 8. NMI annual commercial adjusted revenues for PPMUS trips only.



	Revenues per PPMUS Trip ($)					
	All Pelagic Species		Tunas		Other PPMUS	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	159	288	121	219	19	35
1984	183	304	145	241	15	25
1985	189	303	122	195	26	42
1986	262	409	172	269	24	38
1987	292	436	157	235	32	48
1988	315	447	209	296	40	57
1989	279	374	218	292	17	23
1990	289	370	219	280	39	49
1991	295	348	199	235	64	76
1992	228	248	130	142	71	78
1993	192	201	125	125	47	53
1994	197	201	129	132	36	37
1995	**197**	**197**	**131**	**131**	**36**	**37**
Average	237	317	160	215	36	46
Standard Deviation	53	88	39	64	17	17

Source and Calculation

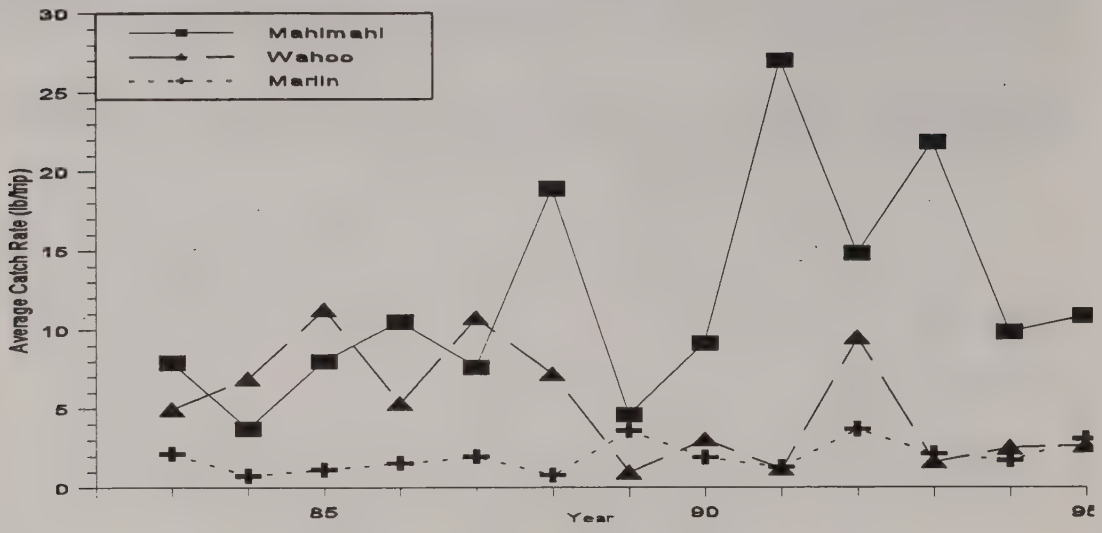
Values were obtained by selecting, from the Commercial Purchase Data Base, all trips which landed at least one PPMUS, and then calculating a) the average revenue of all species, b) the average revenue of other PPMUS only, and c) the average revenue of tuna only. Inflation-adjusted revenues were derived from the NMI Consumer Price Index (CPI) which used 1995 as a base.

Interpretation

The decline of inflation-adjusted revenues per trip for "All Pelagic Species" and "Tunas" continued to be stable in 1995. The current year inflation-adjusted values for all categories are still well below their respective 13-year means.

Inflation-adjusted revenue per trip for "Other PPMUS" remained constant from 1994. The reason for the initial decrease in 1993-94 is unknown.

Figure 9. NMI trolling catch rate of mahimahi, wahoo and marlin.



	Trolling Catch Rate (lb/trip)		
Year	**Mahimahi**	**Wahoo**	**Marlin**
1983	7.92	4.98	2.15
1984	3.73	6.90	0.76
1985	8.02	11.29	1.15
1986	10.50	5.35	1.57
1987	7.61	10.73	1.97
1988	18.87	7.17	0.80
1989	4.60	0.99	3.59
1990	9.13	3.04	1.92
1991	26.95	1.21	1.32
1992	14.79	9.47	3.68
1993	21.80	1.64	2.14
1994	9.82	2.53	1.73
1995	**10.84**	**2.66**	**3.09**
Average	11.89	5.23	1.99
Standard Deviation	6.87	3.62	0.96

Source and Calculation

Annual catch rates for selected species were obtained by calculating the average weight per trip for each year. Trips were assumed to be one day in length and each commercial invoice assumed to represent one trip.

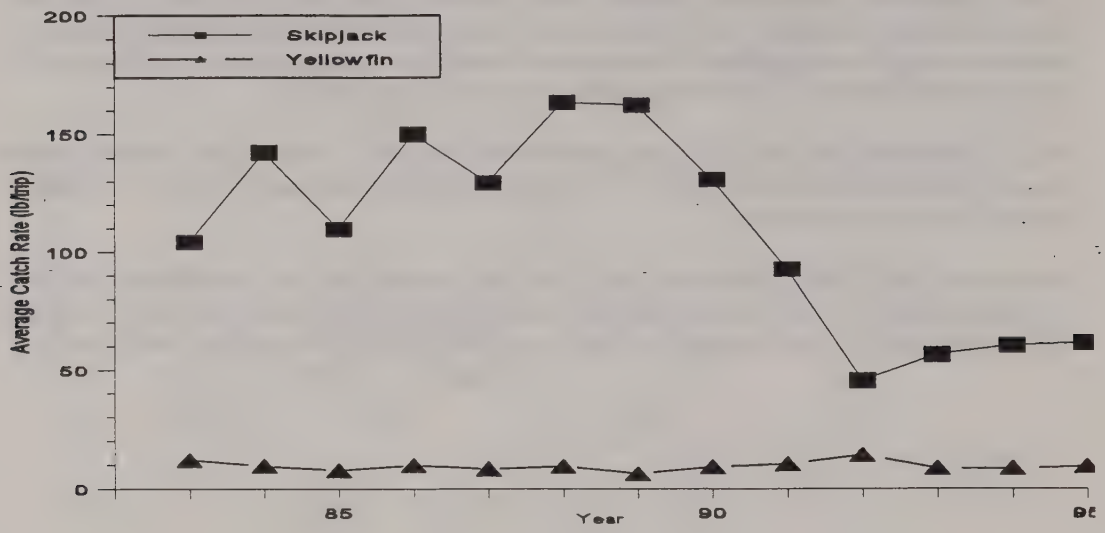
Interpretation

The 1995 mahimahi catch rate increase over 1994, but was still less than half of the 1993 rate, and under the thirteen year mean. This could be due in part to the loss of the FADs, which attract the species, making it more accessible. It may also be biological-- note that the trolling catch rates of Guam and the NMI have fluctuated similarly over the last twelve years.

Prior to the 1989 record low, wahoo catch rates rivaled mahimahi. Wahoo catch rates have generally never regained those historical levels. The 1995 catch rate increased from 1994, but was little more than half the twelve year mean.

Marlin catch rates, relative to mahimahi and wahoo, are normally fairly low (record high catch rate of 1.7 kg/trip in 1992). The 1995 catch rate increaszed to the third highest recorded level. It surpassed the 13-year mean., and correlated with the 'three-year peak' noticed in the landings data from Fig. 2.

Figure 10. NMI trolling catch rates of skipjack and yellowfin tuna.



	Trolling Catch Rate (lb/trip)	
Year	**Skipjack**	**Yellowfin**
1983	104.21	12.09
1984	142.40	9.59
1985	109.75	7.71
1986	150.07	9.98
1987	129.33	8.37
1988	163.25	9.42
1989	162.08	6.36
1990	130.55	9.20
1991	92.46	10.41
1992	45.47	14.25
1993	56.48	8.65
1994	60.42	8.68
1995	**61.52**	**9.42**
Average	108.31	9.55
Standard Deviation	41.97	1.96

Source and Calculation

Data were summarized from the Commercial Purchase Data Base, which provides average pounds caught per trip. Annual catch rates for selected species were obtained by calculating the average weight per trip for each year. Trips were assumed to be one day in length and each commercial invoice represents one trip.

Interpretation

Catch rates for skipjack tuna decreased dramatically commencing in 1990. Although the 1993 through 1995 catch rates show signs of stabilizing, they remain far below their respective means. Skipjack tuna are the preferred species in the troll fishery of the NMI because of their relative ease of capture and local popularity as sashimi. Previous discussions have suggested that non-tuna PPMUS may be increasing in value and a slight shift in target troll fish may be occurring, especially since the skipjack tuna no longer appear to be as abundant.

Catch rates of yellowfin tuna per trip also appear to have stabilized after having peaked in 1992. In 1995 the catch rate increased to near the thriteen year mean. Yellowfin tuna, although more highly prized than skipjack, were not encountered often and were usually taken incidentally while targeting other species.

Appendix 5

Research and Publications
NMFS Honolulu Laboratory

The following section consists of paragraphs extracted from the NMFS Honolulu Laboratory's contributions to the Southwest Fisheries Science Center's bi-monthly and quarterly activity reports in 1995. (Dr. Robert Skillman, with some new material from Dr. Sam Pooley)

International Symposium on Pacific Swordfish

Honolulu Laboratory scientists participated in the International Symposium on Pacific Swordfish held in Ensenada, Baja California, Mexico, December 11-14, 1994. The symposium was organized by the Centro de Investigación Científica y Educación Superior de Ensenada and the Southwest Fisheries Science Center. Funding was provided by the Mexican Swordfish Fishery Section of the National Fishing Industry Chamber (CANAINPES in Spanish), the Third World Academy of Sciences, and the Northwest Marine Technology, Inc.

With growing market demand for swordfish, fisheries in the Pacific including the Hawaii-based fishery and those off the west coast of the U.S., Mexico, and Chile have expanded significantly in recent years. The purpose of the symposium was to update information on the expanding Pacific swordfish fisheries, exchange knowledge of swordfish trends and swordfish biology, and stimulate international cooperation in swordfish research. Scientists from Australia, Chile, and Japan attended in addition to those from Mexico and the U.S. Swordfish research programs in the Atlantic and Pacific Oceans were also represented.

Three papers were presented by Honolulu Laboratory fishery biologists and another by researchers associated with the NOAA/University of Hawaii Joint Institute for Marine and Atmospheric Research (JIMAR). Robert Skillman presented a paper entitled "Central Pacific Swordfish Status Report" in which he described the recent development of the Hawaii-based longline fishery for swordfish and world landings for perspective, reviewed swordfish biology and population dynamics in the Pacific and Atlantic oceans, and described Honolulu Laboratory fishery monitoring and research strategies. Russell Ito presented the paper "The Hawaii Longline Fishery for Swordfish" coauthored with Robert Dollar and Kurt Kawamoto. This paper profiled the Hawaii-based domestic longline fishery describing the gear and fishing practices, landings and revenue, participants, and the product and its distribution. James Uchiyama's paper "Ageing of North Pacific Swordfish Using Hard Parts" was coauthored with Skillman and Jeffrey Sampaga, biological laboratory technician. Progress made on developing techniques for determining the age of swordfish from fin spines, otoliths, and vertebrae and establishing relationships between size measurements for these tissues and whole animal measures were described. A provisional growth model was also presented. Gerard DiNardo of JIMAR presented the paper "Spatio-temporal Dynamics of Broadbill Swordfish (*Xiphias gladius*) Landings in the Hawaii-based North Pacific Pelagic Longline Fishery." The paper, coauthored with fellow

JIMAR investigator William Kwok, characterized the spatial and temporal dynamics of swordfish landings in the Hawaii-based domestic longline fishery and developed preliminary length-based metrics of fishery performance.

Several other papers were presented by staff at the La Jolla Laboratory, SWFSC. (R. Skillman, (808) 943-1257)

Trans-Pacific Migration of Northern Bluefin Tuna Studied

Jeffrey Polovina, chief of the Ecosystem and Environment Investigation, Honolulu Laboratory, has been studying the dynamics of the trans-Pacific migration for the northern bluefin (*Thunnus thynnus*). In recent years the Hawaii-based longline fishery has reported occasional catches of juvenile bluefin as the bluefin migrate from the western to the eastern Pacific. Since the mid-1970s bluefin catches off Mexico and California have been declining, and a recent review of the northern bluefin stock by IATTC scientist William Bayliff has suggested that a reason for the decline in eastern Pacific catches may be related to a decline in the proportion of fish migrating from the western Pacific to the eastern Pacific. Polovina has found a coherent relationship between the proportion of Pacific bluefin catch coming from the western Pacific and the abundance of a bluefin prey, the Japanese sardine (*Sardinops melanosticta*). During 1960-75, when sardines were scarce, western Pacific catches accounted for about 50 percent of the North Pacific catches, while during the 1950s and 1980s when sardines were abundant, 80 percent of the North Pacific catches came from the western Pacific. The age composition of the western Pacific catch shows a 50 percent increase in ages 2-5 bluefin (the ages of fish usually caught in the eastern Pacific) when sardines are abundant off Japan. Thus, it is hypothesized that the proportion of bluefin tuna which migrate from western to eastern Pacific vary with the abundance of sardines off Japan. When Japanese sardines are abundant, fewer bluefin migrate to the eastern Pacific. If the abundance of sardines off Japan continues to decline, this hypothesis forecasts an increase in catches of bluefin in Hawaii and the eastern Pacific. (J. Polovina, (808) 943-1218)

Honolulu Laboratory Hosts Turtle Survivability Workshop

The Honolulu Laboratory hosted a workshop on Turtle Handling, Resuscitation, and Avoidance, March 15-17, 1995. Participants included marine turtle biologists and veterinarians, National Marine Fisheries Service at-sea observers, and representatives from the longline fishing industry. A scientist and a fishing industry representative from Japan also participated in the workshop. Hawaii-based longline fishermen have been asked to provide their comments on the preliminary workshop recommendations.

The primary objective of the workshop, as agreed upon by the participants, was to prepare practical guidelines for improving the survivability of marine turtles taken incidentally in the Hawaii-based longline fishery. These guidelines will respond to the NMFS Biological Opinion (7/25/94) concerning interactions between the Hawaii-based domestic longline fishery and protected marine turtles.

Workshop presentations examined the background of the Hawaii-based longline fishery, the

experiences of the NMFS observers, and marine turtle physiology. Participants prepared detailed recommendations for both fishermen and observers. These guidelines cover fishing vessel operations, procedures for retrieving and releasing turtles, and methods for assessing and treating turtles that are hooked or entangled. The criteria for decisions ensuring survivability of protected marine turtles were also addressed. Workshop guidelines, which will include recommendations for determining long-term assessment of the effectiveness of these survivability measures, will be used to educate fishermen and to implement current regulations.

The workshop guidelines will be presented in a Honolulu Laboratory administrative report that will identify their rationale, their advantages and disadvantages, and detailed measures for implementation where appropriate. These guidelines will be reviewed by the Southwest Region, in consultation with NMFS Headquarters, to determine whether formal regulatory action will be required. (G. Balazs, 808-943-1240)

Possible Link Between Bluefin Tuna Migration and Sardine Abundance Investigated

During the past year, Hawaii-based longline vessels reported sporadic catches on northern bluefin tuna, *Thunnus thynnus*, north of the Hawaiian Islands. Given the high value of these fish and the possibility that they could be targeted by the fishery, Fishery Biologist Jeffrey Polovina reviewed the current research on their population dynamics. Tagging data suggests that northern bluefin tuna spawn only in the western Pacific and that a portion of the juveniles migrate to the eastern Pacific. During the past decade, catches of northern bluefin in the eastern Pacific have declined. One cause for this decline that has been proposed by bluefin stock assessment studies is a decline in the proportion of bluefin that migrate out of the western Pacific. Polovina examined several indices of the relative abundance of bluefin tuna in the western and eastern Pacific. These indices suggest fewer bluefin migrating to the eastern Pacific since 1977. This period of reduced bluefin migration coincides with the period when a prey of bluefin, Japanese sardine, *Sardinops melanosticta*, are abundant in the western Pacific. Polovina hypothesizes that in years when sardines are abundant in the western Pacific, a higher proportion of bluefin stay in the western Pacific compared to years when sardines are scarce. Currently, sardines are declining in abundance in the western Pacific, and if this decline continues this hypothesis predicts an increase in bluefin migrating north of Hawaii and into the eastern Pacific. (J. Polovina, 808-943-1218)

Hawaii Fleet Industry and Vessel Economic Project Status

The Hawaii Fleet Industry and Vessel Economics Project (HIFIVE), a cooperative effort between the Honolulu Laboratory's Fishery Monitoring & Economics Program and the Joint Institute for Marine and Atmospheric Research (JIMAR) of the University of Hawaii, began its research in January 1994 with a cost-earnings analysis of the Hawaii-based domestic longline fishery for 1993. Research objectives of this project include (1) determining the costs, earnings, and returns (both economic and financial) for various fishery sectors, (2) determining the sensitivity of returns to changes in input/output prices and quantities, and (3) determining the levels of output (catch) or prices required for vessels to break even.

According to JIMAR Economist Marcia Hamilton, progress on this project has been excellent.

Vessel captains or owners of 100 of the 122 vessels that longlined in Hawaii in 1993 have been surveyed successfully. Responses were coded and entered into a respondent survey data base and merged to obtain a vessel-level survey data base. In addition, a trip-level operations and revenue data base was constructed from Federal longline logbook and State of Hawaii landings reports. This information was integrated with the cost survey data base. Considerable time was spent in dealing with missing information from the survey or from the linked cost-revenue data base and in categorizing vessel operational characteristics that will generate further analytical results.

The draft results of the cost-earnings analysis were presented by Hamilton at the May 1995 Tuna Conference at Lake Arrowhead, California, with a draft report to be prepared by August 1995. A substantial commitment of time during late spring 1995 involved verification of summarized and categorized cost and earnings information with focus groups of vessel captains and owners and more detailed analysis of revenue.

The HIFIVE project is entering its third year and is embarking on several new studies. A component of the project also applies to an FY96 proposal by collaborating investigators on the movement of longline fishing vessels between the U.S. mainland and Hawaii, and an on-going dissertation project through the University of Maryland.

The troll-handline cost-earnings study was initiated in late 1995 with development of an information collection approach and instrument. The fishing community was informed of the project through an article in Hawaii Fishing News. Pre-testing was initiated in early 1996 and full fielding with a staff of three is currently underway, with over 215 interviews completed on Oahu and Kauai. Because of difficulties in "screening" for full-time commercial fishers, the study is being applied broadly; categorization of the results will be based on empirical criteria. This part of the project is collaborating with a JIMAR visiting scientist project on the socio-anthropology of the the distinction between recreational and commercial fishing in Hawaii and a PFRP recreational valuation project with the University of Maryland which will begin in mid-1996.

Completion and publication of the current longline vessel economic dynamics research and description of industrial structure is anticipated, as well as an input-output analysis of the longline fishery and extension of the fishing effort analysis to tuna longline fishing, along with reporting the the troll-handline cost-earnings research. (M. Hamilton, 808-943-1213)

Video Cameras Provide First Insight Into Hawaiian Monk Seal Foraging Ecology

During November 1995, eight adult male Hawaiian monk seals (*Monachus schauinslandi*) at French Frigate Shoals in the Northwestern Hawaiian islands were fitted with video recording instruments. These "crittercams" were provided by National Geographic Television and were evaluated by Honolulu Laboratory researchers as a data collection instrument to assess the seals' foraging strategy. The video cameras were set to record images and sounds at periodic intervals (for example, 3 minutes every 30 minutes) during the time the seal was at sea. Depth profiles of the seals' movements were recorded continuously throughout the deployment. All of the cameras deployed were retrieved in good condition.

Preliminary examination of the resulting videotape and depth data indicated that the seals foraged at depths ranging from 10 to 90 meters but always targeted benthic associated fauna. Prey items identified included reef fish and octopus. Foraging activity included opportunistic searching of the shallow bottom as the seals moved between haulout sites and periods of intense diving and searching of 60- to 90-meter habitat on the slopes of the atoll. Some of this deep habitat contained numerous rocks that one seal was observed to routinely flip over to get to the animals that the monk seals eat which are hiding underneath. Supplementary information, such as aggression between adult and juvenile seals, was also apparent in the videotapes.

This work has provided researchers with unique insights into the foraging strategies of adult monk seals and has distinguished National Geographic's crittercam as a valuable tool for studying foraging behavior. Additional studies are planned for August 1996. (F. Parrish (808) 943-1254).

Pelagic Fisheries Research Program

The Pelagic Fisheries Research Program (PFRP) was established by the Western Pacific Regional Fishery Management Council in 1992. The program is housed in Honolulu at the Joint Institute of Marine and Atmospheric Research (JIMAR), School of Ocean and Earth Sciences and Technology (SOEST), University of Hawaii at Manoa. The PFRP currently supports over 25 different research projects. The projects involve more than 28 different principal investigators from various institutions including the University of Hawaii, five mainland universities, two NMFS laboratories, foreign laboratories, and private consultants. Numerous associate researchers and student helpers are employed by these projects through JIMAR.

Current Status

The PFRP currently funds approximately 30 active research projects and is entering its third year of active research. As the first round of research projects near completion a significant body of research results has accumulated. The first public presentation of results occurred at the November, 1995 PFRP workshop, and the abstracts of the workshop presentations were published as a PFRP technical report[1]. Reports from several other PFRP projects are in final form and will also be published as technical reports in 1996.

The PFRP Steering Committee commissioned an independent panel to conduct a general review of the PFRP. The terms of reference of the Panel were: (1) generally review priorities for research on pelagic fisheries; (2) assess the scope and progress of the current research program in relation to existing priorities and in relation to broader areas of pelagic fishery research; (3) recommend new general research priorities; (4) recommend specific research topics of high priority; and (5) comment on other matters arising from the review. The review occurred during the November, 1995 workshop and the panel presented its report to the steering committee in January, 1996. The review results were

[1] Sibert, J. and M. Nunn, ed. 1996. Pacific Pelagic Fisheries: Current Projects and Related Research. Abstracts of papers presented November 28-30, 1995. East-West Center, 1777 East-West Road, Honolulu, HI. SOEST 96-01, JIMAR Contribution 96-299. 49 p.

generally very favorable, but the Panel suggested improvement in several areas. The most important general area for improvement is communications. Specifically the Panel recommended production of a "project document", publication of articles in the popular press, creation of a more comprehensive annual report, publication of a quarterly newsletter, and, of course, publication of scientific articles. The Panel also recommend research in the following areas: (1) fisheries bycatch and discards; (2) allocation; (3) over-capitalization; (4) fisheries monitoring, control and surveillance; (5) sports fishing targeting pelagic species.

Most of the proposals approved by the Steering Committee in 1995 received funding from the FY95 appropriation. However, several proposals required minor revisions, and the resulting delay has made it difficult to secure funding. There appear to be adequate funds in the FY96 appropriation, but it has proven difficult to actually commit funds. The delays have caused severe timing and coordination problems for several projects. Budgetary uncertainty will also delay solicitation of proposals directed toward the recommendations of the Review Panel. (Dr. John Sibert)

Because there are so many projects in the PFRP, just the titles and principal investigators are listed below. Please refer to the status report produced by JIMAR for details and status of each project[1].

Several publications resulting from PFRP projects have appeared recently. These include a status report from a workshop held in November 1995, use of laser imaging for pelagic fish surveys[2], cost-earnings study of the longline fleet[3], and social aspects of troll and handline fisheries[4].

Project Titles and Principal Investigators:

1. Local pelagic catch and effort data analysis and integrated modeling to quantify the effects of local fisheries on fish availability. Principal Investigator: C. Boggs. Collaborating investigators: D. Curran, X. He, Q. Yang.
2. Analysis of Pacific blue marlin and swordfish population structure using mitochondrial and nuclear DNA technologies. Principal investigators: B. Block and J.Graves; collaborating investigators: V. Buonaccorsi, J. McDowell, C. Reeb, P. Rosel.
3. Automated monitoring of yellowfin tuna at Hawaiian Fish Aggregation Devices and the relationship to water mass dynamics based upon satellite imagery. Principal investigator: P. Klimley; collaborating investigator: C. Holloway.

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[1]Sibert, J. 1996. Pelagic Fisheries Research Program - Progress Report. February 1996. Joint Institute of Marine and Atmospheric Research, School of Ocean and Earth Sciences and Technology, University of Hawaii. 26 p.

[2]Schoen, C. and J. Sibert. 1996. Feasibility of Dual Mode Lidar for Pelagic Fish Surveys. SOEST 96-02, JIMAR Contribution 96-301. 18 p.

[3]Hamilton, M. S., R. E. Curtis, and M. D. Travis. 1996. Cost-Earnings Study of the Hawaii-based Domestic Longline Fleet. SOEST 96-03, JIMAR 96-300. 59 p.

[4]Miller, M. L. 1996. Social Aspects of Pacific Pelagic Fisheries - Phase I: The Hawaii Troll and Handline Fishery. SOEST 96-04, JIMAR 96-302.

4. Reproductive biology of yellowfin tuna, *Thunnus albacares*, in Hawaiian waters and the western tropical Pacific Ocean. Principal investigators: G. Grau, R. Shomura, D. Itano.
5. Physical characteristics of the environment influencing pelagic fishes. Principal investigator: P. Flament; collaborating investigators: C. Lumpkin, J. Firing.
6. Hawaii fishing vessel economics (HIFIVE). Principal investigator: S. Pooley; collaborating investigators: R. Curtis, M. Hamilton, S. Huffman, R. Ito, M. Travis.
7. Social aspects of the Hawaiian pelagic troll fishery. Principal investigator: M. Miller.
8. Structure and dynamics of the U. S. tuna market for fresh Pacific tuna and marlin. Principal investigators: J. Kaneko, P. Bartram, P. Garrod.
9. Contributions of tuna fishing and transshipment operation to local economies. Principal investigator: M. Hamnett.
11. Integrative modeling in support of the Pelagic Fisheries Research Program: Spatially disaggregated population dynamics models for pelagic fisheries. Principal investigator: J. Sibert.
12. Design of tag-recapture experiments for estimating yellowfin tuna stock dynamics, movement and fishery interactions. Principal investigators: P. Bills, J. Sibert; collaborating investigators: C. Boggs. P. Kleiber, J. Wetherall.
13. Laboratory and field research to enhance understanding of tuna movements and distribution, and to improve stock assessment methods. Principal investigators: R. Brill, G. Grau, K.Holland.
14. Integration of longline fishery performance model with environmental information. Principal investigator: C. Boggs; collaborating investigator: K. Biglow.
15. Evaluation of remote sensing technologies for the identification of oceanographic features critical to pelagic fish distributions around the Hawaiian archipelago. Principal investigators: G. Mitchum, J. Polovina.
16. A multilevel and mulitobjective programming model of Hawaii commercial fisheries. Principal investigators: P. Leung, S. Nakamoto, U. Chakravorty.
17. A tag and release program for the Hawaiian seamount yellowfin and bigeye tuna handline and troll fisheries. Principal investigator: K. Holland.
18. Feasibility of airborne laser devices for pelagic fish surveys. Principal investigators: J. Sibert, C. Schoen.
19. Three-dimensional laser confocal microscopy as a tool to age fish otoliths by optical sections: validation of daily microincrements by both injected dyes and theoretical otolith growth models. Principal investigator: R. Gauldie.
20. Stock and fishery dynamics of yellowfin tuna, *Thunnus albacares*, in the western and central Pacific Ocean: development of an integrated model incorporating size and spatial structure. Principal investigators: J. Hampton. D. Fournier.
21. A numerical investigation of ocean circulation and pelagic fisheries around the Hawaiian Islands. Principal investigators: B. Qiu, P. Flament; collaborating investigator: D. Koh.
22. The economics of recreational fishing for pelagics in Hawaii. Principal investigators: K. McConnell, S. Pooley.
23. Genetic analysis of population structure in pacific swordfish (*Xiphias gladius*) using microsatellite DNA techniques. Principal investigators: B. Block , C. Reeb.
24 Investigation of pacific broadbill swordfish migration patterns and habitat characteristics using electronic archival tag technology. Principal investigators: C. Boggs, J. Gunn.

25. An assessment of bigeye tuna (*Thunnus obesus*) population structure in the Pacific Ocean, based on mitochondrial and microsatellite DNA variation. Principal investigators: J. Hampton, P. Grewe.
26. Estimation of bycatch and discards of sharks and other species by the Hawaii longline fishery. Principal investigator: X. He.
27. Coordinated sociocultural investigation of pelagic fishermen in American Samoa and the Commonwealth of the Northern Mariana Islands. Principal investigators: R. Franco, M. Hamnett; C. Severence. *(Funds received.)*
28. A sociocultural study of pelagic fishing in Guam. Principal investigators: D. Rubenstein and T. Pinhey. *(Funds not received.)*
29. A dynamic model to evaluate the economic effect of regulation on the Hawaii commercial multifishery. Principal investigators: U. Chakravorty, P. Leung, S. Nakamoto. *(Funds not received.)*.
30. Economic interactions between United States longline fisheries. Principal investigators: M. Travis, I. Strand *(Funds not received.)*.
31. Traditional fishery knowledge: its application to the management and development of small-scale tuna fisheries in the United States Pacific islands. Principal investigators: J. Kaneko, P. Bartram, M. Miller, J. Marks. *(Funds not received.)*.
32. Economic contributions of Hawaii fisheries. Principal investigators: P. Leung, S. Nakamoto, U. Chakravorty. *(Funds not received.)*.
33. Aspects of the ecology of the Red Squid (*Ommastrephes bartramii*), a potential target for a major Hawaiian fishery. Principal investigators: R. Young, J. Hirota. *(Funds not received.)*.

Research Around the Region

A large number of organizations conduct research on Pacific pelagic fisheries that is of direct relevance to the WPRFMC. Some of these institutions are: South Pacific Commission (Noumea, New Caldeonia); Inter-American Tropical Tuna Commission (La Jolla, California); National Marine Fisheries Service (Southwest Fisheries Science Center, La Jolla and Honolulu Laboratories, http://www.swfsc.ucsd.edu/index.html); CSIRO (Hobart, Australia; http://www.ml.csiro.au), National Research Institute of Far Seas Fisheries (Shimizu, Japan; http://www.ss.enyo.affrc.go.jp/indexe.html), National Fisheries Research and Development Agency (Kyongnam, Korea), Institute of Oceanography, National Taiwan University (Taipei, Taiwan). This list is of course incomplete and no slight is intended to people and institutions not included. The list of research activities is long so only a few are mentioned here. (Dr. John Sibert)

South Pacific Commission

The SPC Offshore Fisheries Program works in three principal areas: fisheries statistics, biology, and stock assessment and modelling. The OFP is responsible for the ongoing collection of fisheries statistics from tuna fishing activities in the EEZs of SPC member countries. The major database, which has been maintained continuously since 1981, is the catch and effort logbook database. This database consists of set-by-set (or day-by-day) information for domestic and foreign licensed longline, purse seine and pole-and-line vessels fishing in the region. The current size of the database is

approaching two million records. The OFP also maintains databases of aggregated data, usually consisting of 1 or 5 square-month summaries for individual fleets that represent total catch and effort throughout the whole region. Extensive collections of size composition data have also been complied, much of which has been collected and made available by various national fisheries agencies. The OFP has now established port sampling and observer programs to collect size composition and other data from most fleets operating in the region. A final report on by-catch and discards by the industrial fleet will be published in 1996. A study of daily periodicity of annuli on otoliths is underway. An analysis of the environmental determinants of tuna production is analyzing the link between patterns of primary productivity and hypothesized secondary productivity with the distribution of catch and CPUE; and the relationships between fishery performance and various environmental parameters. A study of stock structure of bigeye tuna in the Pacific Ocean is underway in collaboration with CSIRO and with partial funding from the PFRP.

The OFP undertakes population modelling and stock assessment using the various sources of data available. The major projects currently being pursued are:

Skipjack and yellowfin assessment using tagging data: The Regional Tuna Tagging Project (RTTP) resulted in the release of approximately 140,000 tuna during 1989-1992, mostly skipjack and yellowfin. Returns to date number in excess of 18,000. These data, along with information on tag shedding and reporting rates, have been used to estimate mortality rates. The average exploitation rate (F/Z) for both species is approximately 0.2. For yellowfin, mortality estimates by size class have been computed which indicate much higher rates of natural mortally for small yellowfin.

Development of tuna movement models: This ongoing research, utilizing the OFP's tagging and catch and effort databases, is being conducted collaboratively with the PFRP

Development of an integrated model for yellowfin assessment: The objective of this project, which is supported by the PFRP, is to develop an age-structured model of western and central Pacific yellowfin that can be fit to catch and effort, size composition and tagging data.

Bioeconomic modelling of western Pacific tuna fisheries: This project is attempting to develop a framework for the estimation of optimal levels of effort in (i) the Solomon Islands purse seine and pole-and-line fishery, and (ii) the regional purse seine, pole-and-line and longline fishery. The strategy in both cases is to develop models that simulate catch and economic performance as a function of effort. Both models have spatial structure and consider multiple gears and species. The regional model also incorporates age structure. The project is a collaborative effort involving the OFP, the FFA and the University of Queensland.

Inter-American Tropical Tuna Commission

The IATTC conducts a wide range of research activities on pelagic fisheries. Most of these activities are directed to management of yellowfin stocks in the eastern tropical Pacific ocean, but many are of particular relevance to WPRFMC concerns. The IATTC has recently conducted a stock assessment of Pacific swordfish that will be of interest to the Council. IATTC staff have also collaborated in the PFRP seamount tagging project by tagging bigeye tuna that have also been injected with

oxytetracycline. The otoliths taken from recaptures of these fish will be used to validate age estimates.

ECOTAP

ECOTAP is a program planned for a three-year period (1995- 1998) to be carried on by EVAAM, IFREMER, ORSTOM based in Papeete, French Polynesia. The first two years are dedicated to field work. This program is designed to study the habitat and resources of tuna targeted by small and medium-sized longliners based in French Polynesia. This relatively new fishery developed rapidly during the past four years, and supplies the local market of fresh tunas at relatively good prices (4 to 8 US $/kg). Total catches reach an estimated 3500 mt for 1995. The main objective of ECOTAP are: (1) Improve fishing efficiency by providing information on spatial (in EEZ) and seasonal availability of tuna and on the behavior of tuna attracted by FADs; (2) Assess the local stocks of important species, such as bigeye, albacore, yellowfin in the EEZ, and compare to the current exploitation rates of the stocks Pacific-wide; and (3) Analyze relation between variability of catches and hydroclimatic events such as ENSO at the EEZ-scale.